

CLIMATE CHANGE IMPACTS ON THE TRANSPORTATION SECTOR

HEARING

BEFORE THE

COMMITTEE ON COMMERCE,
SCIENCE, AND TRANSPORTATION
UNITED STATES SENATE

ONE HUNDRED TENTH CONGRESS

SECOND SESSION

JUNE 24, 2008

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SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

ONE HUNDRED TENTH CONGRESS

SECOND SESSION

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CLIMATE CHANGE IMPACTS ON THE TRANSPORTATION SECTOR

TUESDAY, JUNE 24, 2008

U.S. SENATE,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
Washington, DC.

The Committee met, pursuant to notice, at 10:33 a.m. in room SR-253, Russell Senate Office Building, Hon. Daniel K. Inouye, Chairman of the Committee, presiding.

OPENING STATEMENT OF HON. DANIEL K. INOUE, U.S. SENATOR FROM HAWAII

The CHAIRMAN. The hearing will come to order.

This Committee, with its diverse jurisdiction, has a history of rising to meet climate change challenges by advancing, in a bipartisan manner, legislation that will make a difference in the fight against global climate change. Legislation passed by this Committee will result in a meaningful reduction of fuel consumption and emissions by increasing fuel efficiency standards for American cars.

In addition, the actions of this Committee have strengthened climate change research programs, addressed ocean acidification, and ensured that adequate information and data are available to help lawmakers, regulators, and planners, among others, make informed decisions and adapt to climate changes.

Today's hearing regarding climate change impacts on the transportation sector is a continuation of the Commerce Committee's work to examine efforts to reduce greenhouse gas emissions in the transportation sector and determine what role the Federal Government should play in encouraging these efforts.

The transportation sector is a major indicator of the overall economic health of our Nation. Given that fact, it is important to recognize that climate affects the design, construction, safety and operations, and maintenance of transportation infrastructure and systems. For example, as we will hear today, predicted increases in precipitation and frequency of storms will impact our transportation systems; recent flooding in the Midwest resulted in submerged highways and railroad bridges, and significant diversion of freight traffic. In addition, severe storms have caused major airport delays around the country.

While there is a need for the transportation sector to adapt to the environmental changes brought on by global climate change, it is also widely recognized that the transportation sector has contributed to the causes of climate change.

Transportation sources account for approximately one-third of U.S. greenhouse gas emissions. And transportation emissions are among the fastest-rising of all emitting sectors, due to increased consumption of gasoline, jet fuel, and diesel fuel. The Environmental Protection Agency estimates that greenhouse gas emissions attributable to the transportation sector will increase 26 percent by the year 2020.

Today's hearing will examine climate change research, mitigation, and adaption results, efforts in the transportation sector, including the surface transportation, maritime, and aviation industries. The Committee looks forward to hearing from the witnesses about how the transportation sector can adapt to the impacts of climate change, increase fuel efficiency, and otherwise reduce greenhouse gas emissions.

We have several witnesses with us today. Panel one consists of the Deputy Secretary of the Department of Transportation, the Honorable Thomas Barrett; Acting Director of the National Institute of Standards and Technology, Dr. James M. Turner; and a Physical Scientist from the National Climatic Data Center, National Oceanic and Atmospheric Administration, Dr. Thomas C. Peterson.

May I call upon Deputy Secretary Barrett.

**STATEMENT OF HON. THOMAS J. BARRETT, VICE ADMIRAL,
DEPUTY SECRETARY, DEPARTMENT OF TRANSPORTATION**

Admiral BARRETT. Mr. Chairman, thank you, and good morning. I'm pleased to appear before you today and discuss the activities of the United States Department of Transportation as they relate to transportation's impact on climate change and the impacts that climate change may have on the Nation's transportation networks.

This Committee brings a breadth of expertise and understanding to transportation's vital role to the United States economy and our quality of life and its impact on the global economy, so we appreciate your leadership on this important subject.

To support the Administration's climate change goals, DOT is working to reduce greenhouse gas emissions from transportation activities and prepare for the impacts of climate change to protect transportation infrastructure. As we pursue these goals, like you, we are mindful of the indispensable role that transportation plays in sustaining and improving our economy. And, like you, we have seen much evidence that markets provide strong incentives for innovation and improvement in efficiency.

With that in mind, under Secretary Peters's leadership, we have focused our approach on improving vehicle efficiency, increasing use of alternative fuels, reducing congestion, advancing the efficiency of the transportation system, and improving our understanding of the impacts of climate change on transportation networks.

The Administration is leading efforts to improve the fuel economy of the Nation's fleet of passenger vehicles and light trucks. Building on a record of fuel economy reforms, DOT announced a CAFE proposal, in April, that would save a projected 55 billion gallons of fuel and reduce U.S. carbon dioxide emissions by 521 million metric tons over the lifetime of the regulated vehicles, going

above and beyond the requirements set out by Congress under the Energy Independence and Security Act.

In addition, the National Highway Traffic Safety Administration is working with the National Academy of Science to develop a study of fuel economy standards for medium- and heavy-duty trucks.

The Administration strongly supports research on, and use of, alternative fuels. The Federal Aviation Administration, for example, is a major partner in the Commercial Aviation Alternative Fuels Initiative, and DOT has, and is, undertaking research required for development of safety standards for future hydrogen vehicles and infrastructure.

And while we look at these, improvements in the efficiency of the existing transportation system can reduce delays and also deliver significant environmental benefits, including greenhouse gas emissions.

The Texas Transportation Institute estimated highway congestion in the United States wastes 2.9 billion gallons of fuel annually, translating to 2.6 million metric tons of unnecessary CO₂. And all of us have been stuck in traffic, watching our fuel gauge creep toward empty as congestion brings traffic to a crawl. DOT has responded with a congestion initiative, a multifaceted program to ease highway, aviation, freight, intermodal, and border congestion through direct user fees and more congestion pricing.

I would invite your attention, also, Mr. Chairman—aviation is a somewhat unheralded but real success story in these areas. Compared to the year 2000, U.S. commercial aviation in 2006 moved 12 percent more passengers and 22 percent more freight, while actually burning less fuel and reducing our carbon input by a million tons. This is a result of airframe, power, and air traffic system improvements. U.S. airlines, in a very competitive market, have committed to another 30 percent improvement by 2025, a goal the industry adopted before the recent spike in fuel prices. And I would urge caution in not hamstringing this flagship U.S. industry that has such global reach by imposed new emission regimes.

Clearly, anyone who has flown lately, though, can attest to the fact that the current aviation system needs fundamental changes. We recognize this and have begun to implement air traffic management procedures, and taken steps to introduce components of the next generation air transportation system. And the FAA is moving to accelerate implementation of that system, in terms you may have heard, to make it more *NowGen* than *NextGen*, and they'll be introducing test pad sites in Florida and several other U.S. city pairs this year.

The Department is also addressing the challenges posed by climate on transportation infrastructure and systems. DOT released, earlier this year, the Gulf Coast study, which provides an assessment of the vulnerabilities of transportation systems in the region, and subsequent phases will focus on developing tools for State and local officials to use as they develop their transportation plans and make investment decisions.

We have also begun to develop a congressionally required report on transportation impact on climate change and ways to mitigate its impact on the changing environment.

In sum, the Department is approaching greenhouse gas mitigation in line with the Secretary's priorities, and I know Congress is, for a safe, efficient, reliable, and, increasingly, a clean transportation network. We take this issue very seriously, as I know the Committee does.

We appreciate the attention and the opportunity to discuss the issue. And I would be pleased to respond to your questions, sir.

[The prepared statement of Vice Admiral Barrett follows:]

PREPARED STATEMENT OF HON. THOMAS J. BARRETT, VICE ADMIRAL,
DEPUTY SECRETARY, DEPARTMENT OF TRANSPORTATION

Chairman Inouye, Vice Chairman Stevens, and distinguished Members, I am pleased to appear before the Committee today to discuss the various activities of the U.S. Department of Transportation as they relate both to transportation's impact on climate change and to the impacts that climate change may have on the Nation's transportation networks. I appreciate your attention on this important subject and the expertise this Committee brings to transportation and the American and global economy.

Addressing the challenge that global climate change presents will require a sustained effort over many years. The Bush Administration is committed to cutting greenhouse gas emissions and to mitigating the impacts of the climate change that occur. This Administration has devoted almost \$45 billion to support climate change-related programs, with an additional \$40 billion in loan guarantees made available to support investments in technologies that promise to reduce greenhouse gas emissions.

The Department of Transportation's principal mission is to ensure the safe, efficient, and reliable performance of our highway, transit, rail, maritime, pipeline, and aviation networks. We also support the Administration's efforts to reduce the Nation's greenhouse gas emissions, not only by working to reduce greenhouse gas emissions from transportation activities, but also by preparing for the impacts of climate change in order to protect our valuable transportation infrastructure. As we pursue each of these goals, we are always mindful of the indispensable role that transportation plays in sustaining and improving our economy, and supporting our trade, and the importance of transportation infrastructure to the millions of Americans who depend on it for their mobility and the competitiveness of their businesses. These goals are all a part of the Secretary's priorities for a safe, efficient, reliable and clean transportation network.

Reducing Transportation's Impacts

I would first like to discuss the Department's approach to the mitigation of greenhouse gas emissions from the transportation sector. Our approach focuses on: improving vehicle efficiency; increasing the use of alternative fuels; advancing the efficiency of the transportation system (often by promoting market-based measures and technological innovations); and improving our understanding of the impacts of climate change on transportation infrastructure.

Let me state at the outset that, although mandates and regulations have their place, new technologies and private sector innovations are really the keys to effectively addressing climate change without compromising the competitiveness of our transportation providers or the shippers and passengers that rely upon them. As evidence, I refer you to the European aviation regulatory model that has encouraged a decrease in overall ridership but an increase in emissions. Compare that to the more open market approach taken in the U.S.—our airlines have increased ridership while at the same time decreased emissions dramatically. Between 2000 and 2006, aviation CO₂ emissions in the U.S. declined by about 4 percent. During the same period in Europe, emissions increased by around 30 percent.

Vehicle and Engine Efficiency

The Administration has been a leader in improving the fuel economy of the Nation's fleet of passenger vehicles and light trucks. Our record in this area speaks for itself. In April, Secretary Peters announced a proposal that would establish the first new fuel economy standards for passenger cars in more than two decades, and would update and expand fuel economy standards for light trucks. Once finalized, this rule would raise 2011 passenger car fuel economy standards by 13 percent and boost light truck fuel economy standards by a further 4 percent above the attribute-

weighted standard set 2 years ago. Overall, the fuel economy standards of the U.S. fleet would be raised by more than 25 percent through model year 2015.

The proposal reflects the fuel economy reforms passed by Congress in December 2007 at the President's urging. Indeed, the new law, the Energy Independence and Security Act (EISA) of 2007, incorporates many of the provisions of the President's "Twenty in Ten" initiative, aimed at reducing light duty vehicle petroleum consumption by 20 percent in 10 years through both improved fuel economy standards and increased use of alternative fuels.

The standards in the proposed rule would save a projected 55 billion gallons of fuel and reduce U.S. carbon dioxide emissions by 521 million metric tons over the lifetime of the regulated vehicles. It also includes provisions for trading fuel economy credits between manufacturers and vehicle classes, as well as provisions for carrying forward excess credits earned in earlier years. This proposal goes above and beyond the requirements set out by Congress.

This proposal builds on earlier initiatives to raise light truck fuel economy under prior law. The Department issued new fuel economy rules for light trucks in 2003 (covering model years 2005–2007), and in 2006 (covering model years 2008–2011). The 2006 rulemaking implemented an innovative attribute-based standard for light trucks that Congress extended to passenger cars in EISA. The two earlier rules are estimated to save 13 billion gallons of fuel over the lifetimes of the regulated vehicles.

Through the Federal Highway Administration's Congestion Mitigation and Air Quality Improvement Program (CMAQ), the Department is working with State and local governments on a range of programs to improve urban air quality within the transportation sector. For example, DOT has cooperated with the Environmental Protection Agency's SmartWay Program initiative to retrofit trucks and truck stops with on-board and off-board auxiliary power to run vehicle lights and air conditioning and reduce truck idling. This program has reduced fuel consumption, criteria pollutant emissions, and greenhouse gas emissions, and has expanded to include idling emissions from marine, agricultural, rail, and off-road heavy-duty engines. The Federal Transit Administration funds the development and deployment of alternative fuel buses, including hydrogen fuel cell buses, and diesel-electric hybrid buses, as well as alternative fuels infrastructure for transit systems across the United States.

The Department also has focused on efficiency beyond the highway. In aviation, we have begun to implement the Next Generation Air Transportation System to modernize the U.S. air traffic system, of which I will say more in a moment. The Federal Aviation Administration is in the process of setting up a new program, CLEEN—Continuous, Low Energy, Emissions, and Noise—a research consortium focused on cost-shared efforts accelerating the maturation of lower energy, emissions, and noise technologies for aircraft and engines and advancing cleaner alternative fuels. The Maritime Administration (MARAD) is focused on new technologies to reduce the harmful emissions from marine diesel engines through research on alternative fuels (such as biodiesel) and reduced ship stack emissions.

Alternative Fuels

The Administration also is supporting research on and use of alternative fuels. The EISA requires fuel producers to supply at least 36 billion gallons of renewable fuel by the year 2022—a 500 percent increase in the use of renewable fuels. President Bush is calling on every vehicle manufacturer that serves the U.S. market to produce flex-fuel vehicles across its fleet, providing tax incentives for drivers to buy fuel-efficient hybrid vehicles that run on both gasoline and electricity and investing in plug-in hybrids that can cover up to 40 miles on electricity alone.

Though corn-based ethanol is currently the primary way to meet that standard, that will not always be the case, and so the Administration also is investing in next generation biofuels such as cellulosic ethanol. Since President Bush took office, the projected cost of cellulosic ethanol has dropped by more than 60 percent.

Last year, the U.S. produced about 450 million gallons of biodiesel—up 80 percent from 2006. Today, there are more than 968 biodiesel fueling stations, and hundreds of fleet operators use biodiesel to fuel their trucks. Over the last 5 years, the Administration has invested about \$1.2 billion in hydrogen research and development to help bring hydrogen fuel cell vehicles to market. These vehicles use no gasoline at all, and emit only clean water.

Even as the Administration focuses on alternative fuels and alt-fuels vehicles, we must ensure that the environmental improvements they bring do not erode the safety levels that Americans expect. Through the National Highway Traffic Safety Administration, the Research and Innovative Technology Administration, and the Pipeline and Hazardous Materials Safety Administration, we have undertaken research

required for the development of safety standards for future hydrogen vehicles and infrastructure.

We are exploring the potential of alternative fuels for aviation—fuels that could have benefits for energy security as well as emissions performance. The FAA is one of the key partners in the Commercial Aviation Alternative Fuels Initiative (CAAFT). CAAFT's participants, which include airlines, manufacturers, airports, fuel producers, Federal agencies and international players, are implementing a roadmap for the use of alternative fuels for commercial aviation. Commercial airlines and manufacturers are beginning to make some headway in experimental use of biofuels in jet aircraft. Using an unmodified Boeing 747, pilots for Richard Branson's Virgin Atlantic have successfully flown from London's Heathrow airport to Amsterdam using a biofuel made of a mix of coconut and babassu oil.

System Efficiency and the Marketplace

As important as research may be, the Department is of course concerned first and foremost about making our networks as safe and reliable as possible. Secretary Peters has made improving the performance of those networks one of the Department's primary objectives, because severe congestion is choking our major urban areas (and, for that matter, more and more medium-sized cities), impeding the efficient flow of goods, and threatening our mobility—to the tune of about \$200 billion every year just on our highways. As we focus on increasing efficiency, we simultaneously can and should reduce the amount of needless greenhouse gas (GHG) and other emissions that those networks generate through idling, inefficient routing, and other undesirable effects.

The problem is significant. The Texas Transportation Institute estimates that highway congestion in the U.S. wastes approximately 2.9 billion gallons of fuel annually, translating into 2.6 million tons of unnecessary CO₂ emissions every year. We think this figure actually underestimates the costs associated with the near-constant congestion that afflicts so many of our cities and our most important highway corridors. I think all of us have experienced this first hand while stuck in traffic watching the gas tank empty as congestion brings highway speeds to a crawl.

The Department has responded with the Congestion Initiative, a multifaceted program aimed at easing highway, aviation, freight/intermodal, and border congestion. As part of the Initiative, we have focused on encouraging states and localities—which, after all, own nearly all our highways—to embrace congestion pricing and direct user fees for both their operational and environmental benefits.

Researchers have for decades predicted the beneficial environmental impacts of pricing, and we have recently seen real evidence of reduced emissions in cities around the world following adoption of congestion pricing. One study found that congestion pricing reduced emissions up to 10 percent in the aggregate and as much as 30 percent in high pollution areas.¹ These benefits are obtained because efficient pricing mechanisms reduce the number of trips taken, alter trip routes, reduce trip duration, decrease variation in travel speeds, and facilitate more pollution-efficient travel speeds. A study of Atlanta during the 1996 Summer Olympics revealed significant benefits.² Several travel demand management measures were introduced to reduce traffic congestion during the 17 days of the games. The study found that daily peak ozone levels dropped 28 percent and hospitalizations for asthma fell by almost 20 percent during that time.

Moreover, with the proliferation of open road pricing technology, highway facilities can achieve free-flow conditions without intrusive tollbooths, thus obtaining the efficiency and environmental benefits of pricing without the harmful impacts of queued vehicles waiting in line to pay.

Real evidence of the emissions benefits of pricing is now available from Singapore, London, Stockholm, and Germany. Through congestion pricing, London reduced emissions of particulate matter and nitrogen oxides by 12 percent and fossil fuel consumption and CO₂ emissions by 20 percent. Singapore uses pricing to manage demand on its downtown road network during peak travel periods and has prevented the emission of an estimated 175,000 pounds of CO₂. Stockholm's congestion pricing system, which targets congestion in the city center, has led to a 10–14 percent drop in CO₂ emissions. In January 2005, Germany implemented a new system to price trucks on the autobahns. These charges, which are collected electronically using Global Positioning System Satellites (GPS), are based not only on distance

¹ Khalid (Daniel & Bekka., 1998. The Environmental Impact of Highway Congestion Pricing, *Journal of Urban Economics*. Volume 47, Issue 2, March 2000, Pages 180–215).

² Friedman & Powell. 2001. Impact of Changes in Transportation and Commuting Behaviors During the 1996 Summer Olympic Games in Atlanta on Air Quality and Childhood Asthma. *JAMA*. Vol. 285 No. 7, February 21, 2001.

traveled and number of axles, but also on a vehicle's emissions class. This system has increased freight efficiency and cut freight greenhouse gas emissions by 7 percent. A 50 percent premium charge for older, more polluting trucks has doubled the replacement rate to new trucks.

Our focus on variable pricing and other direct user fees also responds to the drawbacks of a highway funding model that relies on gas tax revenues even as we strive toward increased energy independence, greater fuel economy in automobiles, development of alternative fuels, and reduced emissions. The EISA, and the increasing popularity of hybrid vehicles, presage reductions in the amount of gas tax revenue available for investment in transportation. Concerns about the viability of gas tax revenues are only exacerbated by the recent increases in fuel prices which have led to reduced vehicle miles travelled on U.S. roads (Americans drove 1.4 billion fewer miles in April 2008 than they did in April 2007, the sixth consecutive monthly drop). As the United States works to reduce emissions and promote alternative fuels, a transportation funding system that relies primarily on the gas tax undoubtedly contradicts the Nation's overall policy objectives. Pricing and other market solutions can help address concerns about the viability of the gas tax by substituting private capital and direct user fees for gas tax revenue.

Because of these benefits, tolling and direct user charges have won support from a wide range of ideological viewpoints in the United States—from Environmental Defense and the Nature Conservancy to the Competitive Enterprise Institute and the Reason Foundation. Recognizing the environmental benefits of this approach, San Francisco Mayor Gavin Newsom stated in his recent inaugural address that a “sensible congestion-pricing plan is the single greatest step we can take to protect [San Francisco's] environment and improve our quality of life.”

All of this is to say that we view congestion pricing as a win-win concept because it generates revenues that can be used to expand and maintain highways or bridges or transit, and it provides users with price signals that encourage rational decisions about how and when to drive—yielding efficiencies that are at once an environmental and economic boon.

Anyone who has flown lately can attest to the fact that the current aviation system needs fundamental changes. I briefly made reference to the Next Generation Air Transportation System, or NextGen. As with congestion pricing, this is an area in which efficiency improvements and environmental advances go hand-in-hand. NextGen aims to improve our air traffic management procedures and route structures so that aircraft can choose more efficient routes, make quicker in-flight decisions to avoid weather and other traffic, and even operate more efficiently on the ground.

The FAA and our commercial airlines have saved 300 hundred million gallons of jet fuel and displaced over 6 million tons of carbon dioxide emissions by implementing Reduced Vertical Separation Minimums (RVSM), permitting aircraft flying in U.S. air space to operate at more efficient altitudes. FAA has achieved further improvements in system performance through the related reforms of Area Navigation (RNAV) and Required Navigation Performance (RNP)—both of which allow for the more efficient routing for commercial air traffic and more reliable service during marginal weather conditions, particularly at congested airports such as Atlanta Hartsfield. If we want to reduce jet fuel consumption and aircraft emissions without discouraging air travel, we must transform our aviation system. As we move to push Automatic Dependent Surveillance Broadcast (ADS-B) into the cockpit, we anticipate still greater efficiency gains. And, because every gallon of jet fuel not burned equates to roughly 20 pounds of displaced CO₂, even small improvements yield huge GHG savings when deployed systemwide.

These advances, combined with the imperative for commercial airlines to save fuel, have produced reductions in GHG emissions that—contrary to frequent criticisms—are quite impressive. Compared to the year 2000, U.S. commercial aviation in 2006 moved 12 percent more passengers and 22 percent more freight while actually burning less fuel, thereby reducing our carbon output by a million tons. U.S. airlines have committed to another 30 percent improvement by 2025. With the recent spike in fuel prices, reduction in schedules, and retirement of older aircraft, fuel consumption by U.S. airlines will continue to decline.

Internationally, the Department supports the International Civil Aviation Organization's continued leadership in the environmental arena and its decisive action in developing a comprehensive plan to mitigate aviation GHG emissions and establishing a new high-level Group on International Aviation and Climate Change to work with ICAO's 190 Member States to implement the plan. We oppose, I should emphasize, the European Union's proposal to include aviation in an “emissions trading scheme,” as both unworkable and contrary to international aviation law.

In 2008, we have seen auto buyers shift toward smaller vehicles and hybrids; airlines modify their fleets (and their operations) to do more flying with fuel-efficient aircraft and to get weight off the airplane; shippers move freight to an increasingly efficient rail network; and commuters utilize transit services in greater numbers. These examples contain a common thread, and, of course, that thread is that the market itself—especially of late—will provide ample incentive for transportation providers and consumers to travel more efficiently and with reduced emissions. The Secretary has demonstrated a clear commitment to improving transit. Cumulative VMT has fallen by 17.3 billion miles since November 2006, and we estimate that greenhouse gas emissions in the transportation sector fell by an estimated 9 million metric tons for the first quarter of 2008. The pain from increased fuel prices that Americans are experiencing at the pump and in the grocery store is real and should not be minimized, but the changes we are seeing in transportation systems response to the high price of oil remind us that the marketplace can be a major ally in reducing transportation's environmental footprint and creating the conditions necessary to spur private sector environmental innovation.

Better Scientific Understanding

I also would like to summarize the Department's efforts to measure and prepare for the impacts that climate change may have on our transportation infrastructure. The Department's Center for Climate Change and Environmental Forecasting was designated by EISA to be the Office of Climate Change and Environment. This virtual organization is the focal point within DOT for multimodal technical expertise on transportation and climate change. Nine DOT operating administrations contribute resources to conduct strategic research, engage in policy analysis, and ensure coordination on multi-modal approaches to reducing transportation-related greenhouse gases and to mitigate the effects of global climate change on the transportation network. Recent and continuing research has focused on a range of topics, including emission modeling, evaluation of State and local efforts, early action, tax credits, alternative fuels, and urban ferries.

Most recently, the Center has focused on research requirements from EISA: first, U.S. DOT has approved a statement of work to conduct an EISA-required report on transportation's impact on climate change and ways to mitigate transportation's contribution. The study will also consider co-benefits of fuel savings and air quality improvement. This report will be conducted in coordination with the Environmental Protection Agency and in consultation with the United States Global Change Research Program. Second, the U.S. DOT, in coordination with a range of other groups, is developing a Transportation and Climate Change Clearinghouse to provide one-stop shopping for transportation decision-makers and planners.

As part of the NextGen effort to advance our understanding of aviation's effects on climate, the FAA has launched the Aviation Climate change Research Initiative (ACCRI) in partnership with the National Aeronautics and Space Administration (NASA) and other agencies. This initiative will help accelerate our scientific understanding to inform policy decisions in this area.

The Department also is addressing the challenges posed by the impacts of climate change on transportation infrastructure and systems. Our Center for Climate Change and Environmental Forecasting has been studying this question for several years. Early this year, DOT released *The Impacts of Climate Change and Variability on Transportation Systems and Infrastructure: Gulf Coast Study, Phase I*. This study provides an assessment of the vulnerabilities of transportation systems in the region to potential changes in weather patterns and related impacts, as well as the effect of natural land subsidence in the region. The area examined by the study includes 48 contiguous counties in four states, running from Galveston, TX to Mobile, AL.

Based on 21 simulation models and a range of future scenarios, the study found that potential changes in climate, through both sea level rise and subsidence over the next 50–100 years, could disrupt transportation services in several key ways. Twenty-seven percent of major roads, 9 percent of rail lines, and 72 percent of area ports are at or below 4 feet in elevation above sea level, and could be vulnerable to future sea-level rise combined with non-climate related sinking of the area's land mass that is occurring in the area. The study is designed to help State and local officials as they develop their transportation plans and make investment decisions. Subsequent phases of the study are intended to focus on risks and adaptation strategies involved in planning, investment, and design decisions for infrastructure in the Gulf Coast region and nationwide. The study was performed in partnership with the U.S. Geological Survey and State and local researchers, and is one of 21 "synthesis and assessment" reports produced as part of the U.S. Climate Change Science Program.

A similar study that will soon be released is *The Potential Impacts of Global Sea Level Rise on Transportation Infrastructure*. This study was designed to produce rough estimates of how future climate change, specifically sea level rise and storm surge, could affect transportation infrastructure on the East Coast of the United States. Like the Gulf Coast Study, this study's major purpose is to aid policymakers by providing estimates of these effects as they relate to roads, rails, airports, and ports.

In sum, the Department is approaching greenhouse gas mitigation and adaptation in a comprehensive, multimodal, and innovative way, in line with the Secretary's priorities for safety, system performance, and 21st century solutions. I commend the Committee for paying attention to this important subject and appreciate the opportunity to discuss this issue with a group of individuals who are so knowledgeable about our transportation network. I look forward to your questions.

The CHAIRMAN. Thank you very much.
Dr. Turner?

**STATEMENT OF DR. JAMES M. TURNER, DEPUTY DIRECTOR,
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY,
U.S. DEPARTMENT OF COMMERCE**

Dr. TURNER. Yes, sir. Good morning, Mr. Chairman. Thank you very much for the opportunity to appear before you today to discuss the research related to the transportation sector in areas that are related to global climate change underway at the National Institute of Standards and Technology, or NIST.

The well-being of U.S. citizens is affected every day by NIST's measurements, science, and standards work. Virtually every segment of the economy, from transportation to computer networks, banking, food processing, healthcare, communication, depends on NIST research, products, and services. More broadly, the quality of the water we drink, the air we breathe, the energy we use, and the food we eat depends, in part, on that work.

Just as NIST has impacted these technologies in the past, NIST is poised to play an equally important role in our Nation's efforts to address the challenges of climate change. A large part of the work that NIST does for the transportation sector has an impact on climate change.

In the area of transportation, let me start with an example. NIST conducts research and provides measurement science and services that underpin many stages of the transportation sector in auto manufacturing, from the production of materials, like sheet metal for body panels, to monitoring the final quality of the vehicle assembly. NIST's work extends beyond the car to the transportation infrastructure itself, including both fossil and alternative fuels and emissions, to lightweight metals and composites for auto body parts and fuel cells.

Another big area NIST works in is advanced materials, like cement, for bridges and highways. Cement production provides a large amount of CO₂, and NIST's work to improve the quality of cement will lead to less frequent replacement.

Specific areas that I address in more detail in my written testimony include composition, volume, and weight standards for fuels and oil to allow confidence in the trading of low and high sulfur content fuels in competitive markets. This covers everything from measures and standards for fossil fuels, to biofuels, from train cars of coal, to gallons of gasoline at the pump; to gas reference standards for sulfur dioxide and nitrous oxides that enable the auto-

motive manufacturers to meet the EPA standards; allow industry to tune and trade their emissions through the EPA's sulfur dioxide cap-and-trade system; to composition of refrigerants in automotive air-conditioning systems to eliminate chlorofluorocarbons and find replacements that minimize the impacts on the ozone-depletion in the upper atmosphere; to production of roadway materials and the composition, strength, and durability of road and bridge materials and construction techniques to minimize greenhouse gas emissions; to lightweight metal-forming and composites to enable manufacturers to have high-performance, high-durability, and safe materials to increase efficiency in the automotive and aerospace industry; to development of measurements, science, and standards infrastructure to support the development and implementation of advanced alternative fuel sources, such as hydrogen and biofuels; and finally, to the development of the Smart Grid standards for plug-in hybrid electric vehicles scheduled to be in showrooms in 2010.

Automobiles and light trucks consume 79 percent of all U.S. distilled fuel and account for 19.8 percent of all U.S. CO₂ emissions. Lightweight materials are a big part of the solution to reduce our consumption, as lighter vehicles tend to use less fuel.

The Department of Energy's Office of Vehicle Technology states that lightweight materials are needed to "offset the increased weight and cost per unit of power of alternative power trains, hybrids, and fuel cells, with respect to conventional power trains."

The transportation industry, particularly the automotive and aerospace industry, is looking for lightweight materials, such as new lightweight aluminum and composite materials, to improve fuel efficiency. Introduction of these materials is limited by severe manufacturing difficulties tied to unpredictable small-scale stresses during production. DOE and NIST scientists developed a way to measure and map stresses on this scale using X-ray micro-beams that are 100 times thinner than a human hair. These measurements have solved key scientific questions about how metals deform, and this knowledge will accelerate the introduction of lightweight alloys into fuel-efficient vehicles.

Before I sum up my remarks, I'd like to briefly mention two of our requested budget initiatives for 2009 that will greatly expand our capabilities and ability to have an impact on the broader issue of climate change.

The expansion of the NIST Center for Neutron Research (NCNR) is integral to our programs that impact transportation-related climate change issues because of the ability to image the interior of operating hydrogen fuel cells. Large and small companies involved in the manufacture or use of fuel cells, including General Motors, DuPont, and PlugPower, have benefited from this unique capability.

Industry scientists have stated that the research performed at the NIST Center for Neutron Research has allowed them to jump 5 years ahead in fuel cell development.

The second initiative, which is related directly to the work made possible by the NCNR, is an expansion of our program targeted to enable the use of hydrogen as a fuel. This initiative would expand our work to address more of the technical challenges that need to be overcome before hydrogen can become a practical and economic

alternative fuel, such as its propensity to embrittle materials which could lead to problems in containment and distribution infrastructure integrity, not to mention the challenges associated with measuring and distributing it to ensure equitable sale in the marketplace.

Today, more than any other time in our history, technological innovation and progress depend upon NIST's unique skills and capability. Helping the U.S. to drive and take advantage of the increased pace of technological change is a top priority for NIST. The technologies that emerge as a result of NIST's development of measurement science and standard tools will enable U.S. companies to innovate and remain competitive. That absolutely includes the need to develop both information and measures to enable the United States and other nations to deal with the potential and real climate-related impacts of transportation systems and components.

This concludes my remarks, and I'll be happy to answer any questions you may have, sir.

[The prepared statement of Dr. Turner follows:]

PREPARED STATEMENT OF DR. JAMES M. TURNER, DEPUTY DIRECTOR, NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY, U.S. DEPARTMENT OF COMMERCE

Chairman Inouye, Vice Chairman Stevens, and Members of the Committee, thank you for the opportunity to appear before you today to discuss the research we do related to the transportation sector on areas that are related to global climate change underway at the National Institute of Standards and Technology (NIST).

The well-being of U.S. citizens is affected every day by NIST's measurement and standards work. Virtually every segment of the economy, from transportation to computer networks, banking, food processing, health care and communication, depends on NIST research, products and services. More broadly, the quality of the water we drink, the air we breathe, the energy that we use, and the food we eat depends in part on that work.

The work NIST is doing on climate change is important. Some of the drivers of climate, such as the sun's output, have small variations that change slowly over time. As a result, climate predictions depend on developing absolute measurements of the sun's energy that can be compared accurately over decades from different sensors. Other important variables include the sizes, shapes, and chemical composition of particles or droplets (aerosols) in the atmosphere. Whether aerosols contribute to the warming or the cooling of the Earth depends upon their composition.

In the area of transportation, let me start with one example. NIST conducts research and provides measurement science and services that underpin many stages of auto manufacturing—from the production of materials like sheet metal for body panels to monitoring the final quality of the vehicle assembly. NIST's work extends beyond the car to the transportation infrastructure itself, including both fossil and alternative fuels; emissions; advanced materials like cement for bridges and highways to lightweight metals and composites for auto body parts; fuel cells; and more efficient and greener manufacturing processes:

In addition, NIST works in the following areas:

- Composition, volume, and weight standards for fuels and oil to allow confidence in trading in low to high sulfur content fuels in competitive markets. This covers everything from measures and standards for fossil fuels to biofuels, and from train cars of coal to gallons of gasoline at the pump.
- Gas reference standards for sulfur dioxide and nitrous oxides that enable automotive manufacturers to meet Environmental Protection Agency (EPA) standards and generally allow industry to tune and trade their emissions through the EPA sulfur dioxide cap and trade system.
- Composition of refrigerants in automotive air conditioning systems to eliminate chlorofluorocarbons and find replacements that minimize impacts on ozone depletion in the upper atmosphere, as well as climate forcing due to these gases.
- Production of roadway materials, and the composition, strength, and durability of road and bridge materials and construction techniques to minimize greenhouse gas (GHG) emissions.

- Lightweight metal forming and composites to enable manufacturers to have high performance, high durability and safe materials to increase efficiency in the automotive and aerospace industry.
- Developing Smart Grid standards for plug-in hybrid electrical vehicles scheduled to be in showrooms in 2010.
- More efficient, greener manufacturing through a partnership with EPA on the Green Supplier Network.

Now I would like to cover some specific work NIST is undertaking to improve efficiencies in the transportation industry that could reduce the impact of the industry on climate change. I also want to note that NIST has requested budget increases in FY09 that would enable us to expand and accelerate our work in this area. It also is important to note that nearly all of NIST's work is planned and done in partnership with others in industry, universities, and government at all levels.

Supporting Innovations in Fossil, Bio Fuels and Hydrogen Fuel Cells—Monitoring Emissions and Developing New Fuel Capabilities and Standards

Fossil Fuels Standard Reference Materials (SRMs)—Standards in Emissions. Beginning in June 2006 the U.S. Environmental Protection Agency mandated ultra-low sulfur diesel (ULSD) fuel to make possible more efficient exhaust emissions. The accurate determination of sulfur in ULSD at low levels is a major measurement challenge with enormous economic consequences, mostly in avoided costs, for petroleum refineries and for every link in the distribution system. To meet this challenge, industry must have highly accurate sulfur standards. These SRMs ensure the accurate make up of the fuel and enable compliance to EPA's regulations regarding sulfur fuels. NIST is the place to go for an SRM for a fossil fuel. NIST's first fossil fuel SRMs were issued in 1967 and continue to be issued today.

These standards represent some of NIST's most successful products. According to the study *Economic Impact of Standard Reference Materials for Sulfur in Fossil Fuels*, NIST work returned a calculated rate of return for the program of 1,056 percent. Studies also demonstrate that NIST standards for sulfur in fossil fuels have a net value to society of more than \$409 million since 1984.

Biofuels. Biofuels have gained popularity worldwide both as a renewable energy source and as a way to reduce greenhouse gas emissions and move away from dependence on fossil fuels. NIST is participating in this arena. The United States, Brazil and the European Union have convened a task force of experts to study existing biofuels standards and catalog similarities and differences between them. Out of this partnership, NIST and Brazil are collaborating on the development of joint measurement standards for bioethanol and biodiesel by the end of 2008.

Getting an Accurate Fill-Up. Working very closely with State weights and measures organizations, NIST has long maintained the standard for ensuring that consumers actually receive a gallon of gas every time they pay for one. Now NIST researchers are incorporating the properties of hydrogen in standards that will support the development of hydrogen as a fuel in vehicles. One of the challenges in the use of hydrogen as a vehicle fuel is the seemingly trivial matter of measuring fuel consumption. Consumers and industry are accustomed to high accuracy when purchasing gasoline. Refueling with hydrogen is a problem because there are currently no mechanisms to ensure accuracy at the pump. Hydrogen is dispensed at a very high pressure, at varying degrees of temperature and with mixtures of other gases. NIST's research and new technological innovations will enable accuracy in hydrogen fill-ups.

Fuel Research for Aviation, Aerospace and Vehicular Transportation. NIST has a major effort underway to characterize and model fuel fluids. All reformulations of these fuels changes the way they operate and NIST is working to identify how they are affected. These liquid fuels have long been the most convenient fuel source for all sectors of transportation—aircraft, rockets, cars, trucks, locomotives and military vehicles. The design and specification of these fuels has environmental considerations. Redesigning fuels with environmental considerations as a factor can only be done after NIST does its job of understanding how different additives and formulations affect the fuel.

Enabling the Use of Hydrogen Fuel. As mentioned above, NIST is working to enable the use of hydrogen as a fuel. Hydrogen offers the possibility of lowering the impact of motor vehicles on the environment, and reducing our Nation's dependence on foreign oil. While the burning of fossil fuels produces carbon dioxide and other emissions harmful to the environment, hydrogen fuel can be made from many energy sources, including renewables, and produces zero emissions.

Technical challenges need to be overcome to make hydrogen-powered vehicles more practical and economical. Fuel cells need to operate as reliably as today's gasoline engine. We need systems that can store enough hydrogen fuel to give consumers a comfortable driving range. We need science-based standards that will guide local officials in establishing codes for building and fire safety as they relate to something like a hydrogen fueling station. And we need a technical infrastructure to ensure the equitable sale of hydrogen in the marketplace, as exists today for gasoline.

Expansion of research efforts at NIST is essential to achieving widespread use of hydrogen as a fuel. The distribution and sale of hydrogen will require entirely new systems for ensuring equity in the marketplace. In Fiscal Year 2009, NIST has requested \$4 million to accelerate its research in this area. NIST has been a leading provider of data on the chemical and physical properties of hydrogen for more than 50 years. It has statutory responsibility under the Pipeline Safety Act of 2002 (P.L. 107-355) to develop research and standards for gas pipeline integrity, safety, and reliability. It is the lead U.S. agency for weights and measures of vehicle fuels, and it develops test protocols for stationary fuel-cell systems, covering issues of efficiency, performance, and compatibility with the power grid for interconnection purposes.

NIST's Center for Neutron Research (NCNR) is the premier facility for real-time, three-dimensional imaging of hydrogen in operating fuel cells. NIST's operations have won awards and wide praise for providing the diagnostics that industry needs to make fuel cells more reliable and less costly. The unique resources developed at this NIST facility will also help reduce technical barriers for efficient hydrogen production and storage. Indeed, NIST participates in two of the three Centers of Excellence established by DOE to develop better means of hydrogen storage.

Transporting and Distributing Hydrogen. Gasoline consumption in the U.S. exceeds 388 million gallons per day and at \$4 a gallon that is a growing investment. Producing hydrogen fuel from domestic energy sources will increase domestic control and substantially reduce greenhouse gas emissions. One barrier to this switch is pipelines. There are currently 700 miles of hydrogen pipelines in operation—that is in comparison to 1 million miles of natural gas pipelines. To move to a more nationwide use of hydrogen, safe and effective pipelines have to be developed. This work will also be part of the NIST Fiscal Year 2009 Hydrogen initiative request of \$4 million dollars to accelerate research in this area. NIST is working on both sensor development to monitor the pipelines and steel and material testing to ensure the safest pipeline possible. NIST is working to establish the codes and standards necessary to ensure safe distribution of hydrogen fuels. The future "hydrogen economy" will depend on efficient transport of fuel across the U.S. In order to use the existing network of pipelines, tests have to be developed to test for the degradation that is likely to occur to the metals that can be caused by hydrogen weakening the pipeline. By establishing the unique test facilities and standard test procedures, we will provide pipeline operators with critical data on the durability of pipeline material in high-pressure hydrogen gas environments.

Hydrogen Storage. Hydrogen is promoted as a petroleum replacement that presents an attractive alternative for fueling automobiles and trucks while maintaining a cleaner global environment. A major roadblock associated with the use of hydrogen is the inability to store it efficiently. Because hydrogen's properties have been shown to embrittle metals and because current storage technologies limit the potential range of hydrogen powered vehicles, NIST is working on measurement tools to determine hydrogen's absorption/desorption characteristics that will accelerate discovery of new materials that can be used to store hydrogen for use across the U.S.

Fuel Cell Research. This is another area where innovations can have an impact on the environment. A huge array of emerging technologies, from new portable electronic devices to smart energy vehicles, depend on the successful development and deployment of efficient, lightweight, reliable and cost-effective fuel cells. The potential market for these new products represents billions of dollars to the U.S. economy. NIST's Center for Neutron Research (NCNR) works with General Motors and others in this area. NIST's expertise is essential for making fuel cells less costly and more reliable.

To develop fuel cells for practical use, NIST researchers are developing measurement methods to characterize the nanoscale structure and dynamics of polymer membranes inside the fuel cell to enable stronger fuel cells. Industry's use of the unique facilities and instruments at NIST will help reduce technical barriers for efficient hydrogen production, storage, and use.

Supporting Innovation in Advanced Materials—Lightweight Materials and Nanocomposites

In addition to the work NIST is doing in the area of hydrogen fuel, other researchers at NIST are looking at materials that will make more efficient cars, airplanes and trains. These efficiencies also will strongly benefit the environment by introducing lighter, more fuel efficient transportation.

Automobiles and light trucks consume 79 percent of all U.S. distilled fuel and emit 19.8 percent of all U.S. CO₂ emissions. Lightweight materials are a big part of the solution to reduce our consumption. The Department of Energy, Office of Vehicle Technologies states that lightweight materials are needed to “offset the increased weight and cost per unit of power of alternative powertrains (hybrids, fuel cells) with respect to conventional powertrains.”

Lightweight Materials for Automobiles. The transportation industry in general, particularly the automotive industry, is looking for lightweight materials such as new lightweight aluminum and high-strength steel alloys to improve fuel efficiency. Introduction of these alloys is limited by severe manufacturing difficulties tied to unpredictable micron-scale stresses during production. NIST and industry scientists developed a way to measure and map stresses on the micron scale using X-ray microbeams that are 100 times thinner than a human hair. These measurements have solved key scientific questions about how metals deform and this knowledge will accelerate the introduction of new lightweight alloys into fuel-efficient vehicles.

NIST is partnering with the automotive industry to accelerate the introduction of aluminum and high-strength steel into automobile production and is collaborating with the Argonne National Laboratory’s Advanced Photon Source and the Oak Ridge National Laboratory to measure stresses in deformed metals at the nanoscale level.

NIST Center for Metal Forming. The NIST Center for Metal Forming is developing the measurements, standards and analysis necessary for the U.S. automotive industry and metal suppliers to transition to new ways of forming metals. This will enable the industry to transition to new advanced and lightweight materials more easily as more accurate data and material models will lead to more accurate die designs, reducing redesign and new model development costs. The reduction of sheet metal forming redesigns through improved material data and models is projected to save the U.S. auto industry a large portion of the \$600 million lost per year on redesigns.

Determining the Life Cycle and Environmental, Health and Safety Performances of Polymer Nanocomposites. Polymer nanocomposites, defined as material systems in which one or more dimensions is less than 100 nm, have greatly improved performance properties relative to traditional polymeric materials and are forecast to make significant inroads in the near future in high volume markets including infrastructure, automotive, and aerospace industries. However, use of these materials in products is hindered by the lack of performance data for them, as well as significant societal concerns regarding the release of significant quantities of nanomaterials into the environment during or at the end of the product service life. Critical information and data is lacking for characterizing and predicting life cycle performance and in-service release rates of nanoparticles from polymer nanocomposites. Although current research focuses on nanoparticle exposure during the manufacturing process, in-service release of nanoparticles from nanocomposites is expected to be greater by several orders of magnitude. NIST will develop and apply measurement science over a wide range of length and time scales to enable a comprehensive understanding of life cycle performance and nanoparticle release rates of polymer nanocomposites.

Timely, accurate, and precise material life cycle performance estimates will enable a revolutionary transformation from initial cost to life cycle cost-based materials selections. Information regarding nanoparticle release rates over the life cycle of nanocomposite materials will ensure safety in commerce by directly addressing public, environmental, and regulatory concerns regarding the environmental, health, and safety aspects of these materials. This research will also foster innovation throughout the nanocomposites supply chain such as material and product manufacturers, and end users and improve the competitive position of U.S. industry in the global market.

While NIST’s work in the automotive and related industries is important to reducing our impact on the environment, there are many ways in which NIST’s research in the area of transportation infrastructure could reduce our impact on our climate.

Supporting Innovation in Transportation Infrastructure Via Concrete Research That Will Have an Impact on the Environment

Most of the U.S. and the world's infrastructure—transportation structures, tunnels, airports, buildings, dams, industrial plants—is made out of concrete. There has been significant work in the area of concrete technology over the last few decades to greatly improve processing and properties making concrete more sustainable.

Why is this important to climate change? The cement and concrete industry is a large generator of greenhouse gas, mainly carbon dioxide (CO_2), during the manufacturing production process. One U.S. ton of cement produces about one ton of CO_2 and the annual world production of cement—2.5 billion tons—is equal to a 3–9 percent estimated share of world man-made CO_2 . In 2006, the U.S. produced 96 million tons of cement and 37 million tons were imported for use in the U.S. It is estimated that 1.5 percent of U.S. man-made CO_2 generation comes from concrete production. And while this is a large number, cement production is forecast to greatly increase over the next 20–40 years because of burgeoning demand for new and replacement infrastructure.

In the U.S., the energy efficiency of cement production is already high, and is probably only capable of fairly small improvements. One is limited to reducing the CO_2 that is given off from the raw materials by partially substituting another material for the cement in concrete, such as the substitution of non- CO_2 containing materials for a portion of the limestone in the raw materials. Around the world, the two most common minerals used to substitute for cement are fly ash and granulated ground blast furnace slag. The use of fly ash and slag in concrete can actually improve the properties of concrete, especially the durability.

NIST is planning to incorporate research on fly ash into our research program in this year and is currently collaborating with several research institutions in submitting joint proposals in response to a Federal Highway Administration Broad Area Announcement pertaining to fly ash. In addition, our researchers have published extensively on the incorporation of fly ash into concrete for other Federal agencies.

Let me highlight some of NIST's work to address the needs of the concrete industry itself. All of our work will improve our understanding of how cement and concrete actually work, and ultimately should make possible improvements in the formulation and use of cement that could save hundreds of millions of dollars in annual maintenance and repair costs for concrete structures and the country's infrastructure. This work should also lead to improving the properties and performance of concrete while decreasing energy costs and reducing the CO_2 emissions from its production.

Using NIST State of the Art Tools to Study Concrete. Using the most modern tools of materials research, researchers from NIST and industry are exploring one of the oldest but most complex construction materials—cement.

Cement may be the world's most widely used manufactured material—more than two billion metric tons are consumed each year—but it also is one of the more complex. And while it was known to the Romans, who used it to good effect in the Coliseum and Pantheon, questions still remain as to just *how* it works, in particular how it is structured at the nano- and microscale, and how this structure affects its performance. NIST's investigations should lead to a better understanding of the contribution of the nanoscale structure of cement to concrete durability, and how to improve it.

Processing of High-Performance Concrete: Mixing and Flow Properties. NIST researchers are looking at ways to develop cement paste and mortar measurement techniques. Researchers are also looking at models of mortar and concrete flow, and guidelines for optimizing the proportioning and processing of high-performance concrete (HPC). At present, there are no generally accepted guidelines for formulating and mixing HPC and no standard tests for measuring the workability of HPC in terms of fundamental flow quantities such as yield stress and plastic viscosity. In the selection of mixture proportions, many methods exist for present-day concretes, but none has received general acceptance and only a few are based on performance rather than prescription; all require the making and testing of numerous batches, which is not the most efficient way to test. We need to link the mixture composition with performance, including flow properties. A method for predicting the flow properties of HPC from mixture proportions will result in a significant reduction of cost in designing HPC mixtures with optimum performance, both in the fresh and hardened states. NIST is developing models to simulate various scenarios to address this issue and to improve the performance of concrete.

Virtual Cement and Concrete Testing Laboratory (VCCTL) Cement Hydration Modeling. A new hydration model is part of a NIST/industry consortium to design, develop, document, and validate a novel, next-generation computer model of microstructure development of hydrating cement paste. The hydration of portland cement

pastes is an extremely complicated phenomena involving many chemical reactions. The VCCTL consortium is committed to the development of a computer model, based on accepted reaction thermodynamics and kinetics that can make reliable predictions of the kinetics of 3-D microstructure development and its dependence on various chemical admixtures. Such a model could become a valuable research tool for cement and admixture companies and could help them reduce the amount of physical testing that they currently perform.

Micro- and Macrostructural Characterization of High-Performance Concrete. NIST is developing methods for characterizing of the micro- and macrostructures of cements and high-performance concrete. To understand how concrete will react under certain circumstances—in numerous environments—one has to understand concrete at the micro level. The methodology developed by NIST will form the basis for assessing and predicting concrete composition and texture influences on performance. This project will lead to an improved understanding of concrete degradation and therefore reduce the need for repeated replacement of concrete and thereby reducing the CO₂ emissions associated with the production of cement.

Simulation of the Performance and Service Life of High Performance Concrete. NIST is also looking at computer simulation algorithms for the service life of high-performance concrete. The service life of HPC depends on almost all performance properties, such as transport properties like resistance to chemical penetration and mechanical properties like elasticity. These properties need to be predicted at the design stage, so that HPC can be designed for durability and lifecycle cost requirements, not just strength requirements. The only accurate way that different kinds of HPC can be handled is to base such predictions on fundamental materials science that includes microstructure, cement chemistry, concrete mixture design, and expected curing. Since concrete is made up of particles at many length scales (e.g., cement, fly ash, silica fume, sand, gravel), quantitative characterization of particle shape is needed so that real particles can be used in these kinds of quantitative models.

Adaptive Concrete Technologies. NIST researchers are investigating adaptive concrete technologies including internal curing and the incorporation of phase change materials into concrete to increase its service life. Field concrete is exposed to a wide variety of environmental conditions and distress. These environmental factors often result in premature degradation and/or failure. Examples include early-age cracking due to shrinkage and degradation as a result of repeated cycles of freezing and thawing, and deterioration due to damaging reactions of chemicals (chloride, sulfate, and alkali ions, etc.). An adaptive concrete is one that dynamically and actively “responds” to these stimuli in such a manner as to reduce their impacts. The results of this research may encourage the industry to have another look at what composition is truly optimum for applications such as pavements and bridge decks, where durability is much more important than strength.

Doubling the Service Life of Concrete. NIST is working to have a dramatic effect on the concrete industry through doubling the service life of new concrete by altering the composition of concrete. One of the main goals of high performance concrete is to increase service life. Under most chemical erosion scenarios, the service life of concrete depends on its reaction to external chemicals entering it. There are a number of ways to significantly increase the service life of concrete including reducing the porosity and adding mixtures to provide increased resistance to the infiltration of chemicals. Unfortunately, one of the side effects of these modifications is a large increase in the propensity for early-age cracking, and the desired barrier performance of a dense concrete is easily compromised by the formation of just a few cracks. Time until the steel reinforcement in the concrete rusts is related to the depth of concrete cover, so that if you increase the thickness of concrete over the steel by 50 percent, you get approximately double the expected service life. More concrete covering the rebar may not be feasible because of design constraints, and both additional concrete and changing the composition to resist chemicals can add considerable cost to construction. NIST researchers propose a different approach to modification of the physical properties of the concrete structure by using a combination of electrical conductivity, ion diffusivity, and viscosity measurements.

In addition to these programs, NIST cement Standard Reference Materials (SRMs) have underpinned product quality for the cement industry for nearly 50 years. The cement SRMs series has proven to be essential to laboratories that certify concrete products for performance and that evaluate mechanisms for concrete corrosion and failure.

Summary

For 107 years, NIST research has been critical to our Nation’s innovation and competitiveness by directly supporting technological advances in broad sectors of the

economy that will quite literally *define* the 21st century—as well as improve the safety and quality of life for all our citizens.

Today, more than at any other time in history, technological innovation and progress depend on NIST's unique skills and capabilities. Helping the U.S. to drive and take advantage of the increased pace of technological change is a top priority for NIST. The technologies that emerge as a result of NIST's development of these tools are enabling U.S. companies to innovate and remain competitive. That absolutely includes the need to develop both information and better tools to enable the United States and other nations to deal with the potential and real climate-related impacts of transportation systems and components.

To ensure that NIST programs deliver the highest impact, the Institute, working with our stakeholders in Congress, industry, academia, and other government agencies, will continue to identify the most critical measurement, standards, and technological challenges—including our efforts that relate to the transportation sector and climate change. We look forward to working with you, Mr. Chairman, and Members of the Subcommittee, throughout this process.

The CHAIRMAN. Thank you very much, Dr. Turner.
Dr. Peterson?

**STATEMENT OF DR. THOMAS C. PETERSON, CLIMATE
SERVICES DIVISION, NATIONAL CLIMATIC DATA CENTER,
NATIONAL ENVIRONMENTAL SATELLITE, DATA,
AND INFORMATION SERVICE, NATIONAL OCEANIC
AND ATMOSPHERIC ADMINISTRATION,
U.S. DEPARTMENT OF COMMERCE**

Dr. PETERSON. Chairman Inouye, Vice Chairman Stevens, Members of the Committee, thank you for this opportunity to talk to you today on the impacts of climate change on transportation.

When the National Research Council started focusing on this topic a few years ago, they didn't find very much solid information on it. I'm pleased to be able to report to you today that this is no longer the case. In addition to the paper the National Research Council commissioned me to write on climate variability and change with implications for transportation, earlier this year the National Research Council released its report on the potential impacts of climate change on U.S. transportation. Also, the U.S. Climate Change Science Program recently released its report on the impacts of climate variability and change on transportation in the Gulf Coast and a report on weather and climate extremes and how they are changing. This latter report, of which I'm one of the authors, is relevant to transportation because transportation is particularly sensitive to changes in extremes, and it was just released last Thursday.

There are five key aspects of climate change that are of greatest relevance to transportation. The first is increases in very hot days and heat waves. Very hot days can cause railroad tracks to buckle and road pavement to rut more easily. They limit some outdoor maintenance activities and can force aircraft at higher elevation airports to lighten their loads.

The second is the increases in Arctic temperatures which are causing a thawing of permafrost on which some transportation infrastructure was built. Also, the melting of Arctic sea ice is raising the potential future opening of a summertime Arctic sea lane, which could save thousands of miles on some shipping routes.

The third—global sea level is rising, and in many parts of the country this will be noticed when storm waters flood farther inland than they would have without sea level rise. In some areas of the

country, such as along the Gulf Coast, local sea level rise can be much greater than global rise, due to land subsidence.

The fourth is increases in heavy precipitation. Flooding from heavy rain damages many types of transportation infrastructure.

And the last feature is increases in hurricane intensities. The number of hurricanes is not projected to increase, but it is likely that their intensity will. Intense hurricanes impact transportation infrastructure through stronger winds, heavier precipitation, and higher storm surges.

NOAA helps the Nation's transportation industry identify and manage risk associated with climate variability and change by serving as a centralized source of relevant and timely weather and climate information needed to support commerce. Specifically, NOAA actively supports the transportation industry in three ways.

The first is through the creation of basic data and models that transportation planners rely on for both adjusting to real-time weather impacts and for making long-range infrastructure decisions.

The second is through NOAA's participation in scientific assessments such as the Intergovernmental Panel on Climate Change. These reports synthesize state-of-the-art scientific understanding that planners need when looking decades into the future.

And the third is outreach and education to data users in transportation and other sectors. For example NOAA hosts annual data user workshops which both educates transportation data users on what relevant data and services NOAA can provide and also educates NOAA on the needs of the transportation sector.

User-specific information is needed, because climate change will affect transportation and transportation infrastructure in multiple ways over the lifetime of the infrastructure, which can be long. The lifetime of roadways is typically 25 years; railroads, 50 years; and bridges and underpasses, 100 years.

When planning a new bridge, for example, designers can take into consideration, among other things, current traffic and potential future traffic; current weather and climate, and potential future weather and climate. The design of the 8-mile-long Confederation Bridge, which connects Prince Edward Island to the Canadian mainland, did just that by taking into account the possibility of a 3-foot rise in sea level due to climate change.

Many other adaptation measures can be adopted. For example, there are methods of laying railroad track that can raise the temperature at which they buckle; some pavement options are more resistant to rutting during hot weather than others; and larger culverts can be placed under railroads and highways to accommodate heavier precipitation.

In summary, to help the Nation respond to this challenge, NOAA provides climate information to the transportation sector to aid in its efficient and safe operation and to help guide infrastructure design to withstand future climate change.

The environmental information NOAA provides is crucial for decision makers in the transportation sector and many other critical areas of the economy every day.

Thank you, again, for inviting me to testify. I'm happy to answer any questions you may have.

[The prepared statement of Dr. Peterson follows:]

PREPARED STATEMENT OF DR. THOMAS C. PETERSON, CLIMATE SERVICES DIVISION, NATIONAL CLIMATIC DATA CENTER, NATIONAL ENVIRONMENTAL SATELLITE, DATA, AND INFORMATION SERVICE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, U.S. DEPARTMENT OF COMMERCE

Mr. Chairman and Members of the Committee, I am Dr. Thomas Peterson, a physical scientist with NOAA's National Climatic Data Center. I am pleased to present a summary of our understanding of the impacts of climate change on transportation infrastructure as well as a description of NOAA's role in creating and providing key information on climate change to transportation decision-makers. I am an author of a National Research Council (NRC) commissioned paper released this past March on *Climate Variability and Change with Implications for Transportation*, along with other colleagues from NOAA and the Department of Energy's Lawrence Berkeley National Laboratory.

My testimony will draw from the NRC paper as well as from three other timely reports of which I am an author of the report on climate extremes:

The Potential Impacts of Climate Change on U.S. Transportation by the NRC Transportation Research Board (TRB) which was released March 11, 2008.

Impacts of Climate Variability and Change on Transportation Systems and Infrastructure—Gulf Coast Study, U.S. Climate Change Science Program (CCSP) Synthesis and Assessment Report 4.7, released March 12, 2008.

Weather and Climate Extremes in a Changing Climate, U.S. Climate Change Science Program Synthesis and Assessment Report 3.3, released June 2008.

Climate Change and Its Impacts on Transportation Operation and Infrastructure

According to the NRC report, five aspects of climate change impact transportation operations and infrastructure: (1) increases in very hot days and heat waves, (2) increases in Arctic temperatures, (3) rising sea levels, (4) increases in intense precipitation events, and (5) increases in hurricane intensity.

Increases in Very Hot Days and Heat Waves

It is highly likely (greater than 90 percent probability of occurrence) that heat extremes and heat waves will continue to become more intense, last longer, and be more frequent in most regions during the twenty-first century. In 2007, the probability of having five summer days at or above 43.3 °C (110 °F) in Dallas was about 2 percent. In 25 years the models indicate that this probability increases to 5 percent; in 50 years, to 25 percent; and by 2099, to 90 percent. Very hot days can have an impact on operations; for example, by limiting periods of outdoor railroad track maintenance activity due to health and safety concerns. High temperatures can have a big impact on aircraft by influencing the limits on payload and/or canceling flights. This is due to the fact that, because warmer air is thinner (less dense), for any given take-off speed the wings of airplanes create less lift when temperatures are high. This causes lower lift-off load limits at high-altitude or hot-weather airports with insufficient runway lengths. Examples of impacts on infrastructure include rail-track deformities, thermal expansion on bridge joints and paved surfaces, and concerns regarding the integrity of pavement.

Increases in Arctic Temperatures

Arctic warming is virtually certain (greater than 99 percent probability of occurrence), as temperature increases are expected to be greatest over land and at most high northern latitudes. As much as 90 percent of the upper layer of permafrost could thaw under higher emission scenarios. The greatest temperature increases in North America are projected to occur in the winter in northern parts of Alaska and Canada as a result of feedback effects of shortened periods of snow cover. By the end of the twenty-first century, temperatures could increase by as much as 10.0 °C (18.0 °F) in the winter and 2.0 °C (3.6 °F) in the summer in the northernmost areas. For the rest of North America, the projected annual mean temperature increase ranges from 3.0 to 5.0 °C (5.4 to 9.0 °F), with smaller increases expected near the coasts. Examples of impacts on operations include a longer ocean transport season and more ice-free ports in northern regions, as well as the possible availability of a northern sea route, or a northwest passage. Examples of impacts on infrastructure include a short season for ice on roads and thawing of permafrost, which causes subsidence of roads, rail beds, bridge supports, pipelines, and runway foundations.

Rising Sea Levels

It is virtually certain (greater than 99 percent probability of occurrence) that sea levels will continue to rise in the twenty-first century as a result of thermal expansion and loss of mass from ice sheets. The projected global range in sea level rise is from 0.18 m (7.1 in) to 0.59 m (23.2 in) by 2099. These estimates do not include subsidence in regions of the Gulf of Mexico and uplift along portions of the New England and Alaskan coasts. They also do not include the dynamics of land ice in frozen regions such as Greenland and Antarctica, which could increase the projection for sea level rise. The *Gulf Coast Study* estimates that a relative sea level rise of 0.5 to 4 feet is quite possible for parts of the Gulf Coast within 50 years, due primarily to land subsidence. With an increase of 4 feet in relative sea level, as much as 2,400 miles of major Gulf Coast roadways could be permanently flooded without adaptation measures. Other examples of the impacts of sea level rise on operations include more frequent interruptions in coastal and low-lying roadway travel and rail service due to storm surge. Sea level rise will cause storm water levels to be higher and flow further inland, exposing more infrastructure to destructive wave forces. Higher storm water levels will in turn require reassessment of evacuation routes, changes in infrastructure design, siting, and development patterns, and the potential for closure or restrictions at several of the top 50 airports, as well as key maritime ports that lie in coastal zones. With 50 percent of the population living in the coastal zone, these airports and ports provide service to the highest-density populations in the United States. Examples of impacts on infrastructure include reduced clearance under bridges; erosion of road base and bridge supports; inundation of roads, rail lines, subways, and airport runways in coastal areas; more frequent or severe flooding of underground tunnels and low-lying infrastructure; and changes in harbor and port facilities to accommodate higher tides and storm surges.

Increases in Intense Precipitation Events

It is very likely (greater than 90 percent probability of occurrence) that intense precipitation events will continue to become more frequent in widespread areas of the United States. Examples of impacts on operations include increased flooding of evacuation routes, increases in weather-related delays and traffic disruptions, and increases in airline delays due to convective weather. Examples of impacts on infrastructure include increases in flooding of roadways, rail lines, subterranean tunnels, and runways; increases in scouring of pipeline roadbeds and damage to pipelines; and increases in road washout, damages to rail-bed support structures, and landslides and mudslides that damage roadways and tracks.

Increases in Hurricane Intensity

It is likely (greater than 66 percent probability of occurrence) that tropical storm intensities, with larger peak wind speeds and more intense precipitation, will increase. However, it is presently unknown how 21st century tropical storm frequency will change compared to the historical data. Increased storm intensity can lead to increased likelihood of negative impacts to operations and infrastructure, even though the number of storms may not be changing. Examples of impacts of increased storm intensity on operations include more frequent and potentially more extensive emergency evacuations; and more debris on roads and rail lines, interrupting travel and shipping. Examples of impacts on infrastructure include a greater probability of infrastructure failures, increased threat to stability of bridge decks, and harbor infrastructure damage due to waves and storm surges.

In addition to the five major aspects of climate change listed above, cold extremes are likely to decrease. This change should have mostly positive impacts on transportation, such as a decrease in ice buildup on marine infrastructure. Also, if the snow season is shorter, roadway maintenance will be easier and highway safety will improve.

In summary, climate change will affect transportation operations and infrastructure in multiple ways. Transportation infrastructures have long lifetimes. For roadways it is typically 25 years, railroads 50 years, and bridges and underpasses 100 years. When planning a new bridge, for example, designers can take into consideration (among other things) current traffic, potential future traffic, current weather and climate, and potential future weather and climate. As illustration of such an adaptation measure, the design of the 8 mile long Confederation Bridge, which connects Prince Edward Island to the Canadian mainland, took into account the possibility of a 1-m (3 feet) sea-level rise due to climate change. Many other adaptation measures can be adopted. For example, there are methods of laying railroad track that raise the temperature at which it will buckle, some pavement options are more resistant to rutting during hot weather than others and larger culverts can be placed under railroads and highways to accommodate heavier precipitation. To help

the Nation respond to this challenge, NOAA provides climate information to the transportation sector to aid in its efficient and safe operation, and to help design infrastructure to withstand future climate change.

NOAA's Role in Providing Climate Information

NOAA helps the Nation's transportation industry identify and manage risks associated with climate variability and change. NOAA supports the transportation industry by serving as the centralized source of relevant and timely weather and climate information needed to support commerce. NOAA's contributions include historical and real-time data, monitoring and assessments, research and modeling, predictions and projections, decision-support tools.

For example:

- NOAA's Climate Prediction Center produces seasonal forecasts used for planning for transport on waterways and stockpiling supplies such as sandbags or salt for roadway (among other functions).
- NOAA's National Climatic Data Center (NCDC) develops national and global datasets that have been used to maximize climate resources and minimize the risks posed by climate variability and weather extremes.
- NOAA's Earth System Research Laboratory, working with the Federal Highway Administration, develops decision-support software applications that use weather forecasts to generate predictions about roadway conditions and recommendations for the frequency of snow plowing and deicing. These efforts help to increase roadway safety and cost-savings due to reduced unnecessary roadway maintenance.
- NOAA's Geophysical Fluid Dynamics Laboratory develops climate models to prepare projections of future climate conditions.
- NOAA's Climate Program Office supports fundamental research aimed at fulfilling NOAA's goal to understand and describe climate variability and change to enhance society's ability to plan and respond.
- NOAA's National Weather Service and NCDC produce many publications that describe the weather and climate of the United States, participate in national and international climate research assessments, and fulfill millions of data customer requests each year.
- NOAA's National Ocean Service provides information on local vertical land movement and local relative mean sea level trends and provides coastal managers with coastal resilience tools and training.

Climate change presents a substantial challenge for future policy and business decision-making, and the demand for climate information from NOAA has increased over the past decade and continues to grow. Designers of transportation infrastructure can use NOAA's climate change information to help guide the design and construction of new infrastructure, so it will withstand climatic changes throughout its designed life time.

NOAA actively participates with other Federal agencies and other organizations, and often takes a leadership role in collaborative climate change assessments and reports. NOAA has worked on both domestic efforts, such as the U.S. Climate Change Science Program (CCSP) report on changes in extremes in North America, and international efforts, including the Intergovernmental Panel on Climate Change (IPCC). These rigorous assessments synthesize the latest climate science to provide authoritative information on how the climate has changed in the past and is expected to change in the future. These reports are widely accessed by the transportation industry.

NOAA has taken a proactive role in understanding the emerging data and information needs facing a variety of data users and decision-makers. As climate services continue to evolve, NOAA recognizes that local, regional, state, and private entities require better information to understand how their localities are contributing to, will be affected by, and can adapt to a changing climate. It is NOAA's goal to provide relevant, user-specific climate information to meet this demand. NOAA has begun to address this through problem-focused initiatives developed collaboratively with users, such as the transportation industry.

For example, in 2007, NCDC hosted a specialized NOAA Data Users workshop to identify the climate data and information requirements of the energy, insurance, and transportation sectors, in the context of a changing climate. The workshop also explored how those emerging information needs might guide future products and services. The feedback gained from this workshop provided an understanding of the needs of each industry, enabling NOAA to maximize the value of the climate products and services it delivers. For instance, in addition to NOAA's role as provider

of historical, current and modeled environmental data, these industries are interested in data about the probability of risk associated with a changing climate.

In summary, NOAA is striving to meet the rising demand for climate data and products, which support decision-making in a number of nationally significant industries including transportation. Government and industry leaders recognize the inherent value in planning for future climate change through an enhanced climate services partnership between the public and private sectors.

Mr. Chairman, thank you for inviting me to discuss the effects of climate change on our Nation's transportation operations and infrastructure. I look forward to working with the Committee on any further information you may require for your deliberations on this topic.

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The CHAIRMAN. I thank you very much, Dr. Peterson.

My staff has prepared several very technical questions, but I'd like to ask other questions, if I may.

None of you have mentioned the price of gasoline at the pumps, or suggested what it should be tomorrow or the following day. I would venture to say that if gas prices were set at \$2.50 a gallon this morning, we would not be holding this hearing, nor would Presidential candidates be concerned about climate change, emissions, or greenhouse gases.

And so, I've done some studying, and I'm not certain whether the information I'm receiving has any bearing. For example, I've been told that 94 percent of the oil we consume in the United States comes from countries or dictatorships, 6 percent by private capitalists. Does that make any sense—94 percent by countries like Saudi Arabia, Iran, the Emirates, nationally owned companies like in Venezuela; and 6 percent by private sources—does that make sense? Any of you.

[No response.]

The CHAIRMAN. We have no idea where the oil is coming from?

[No response.]

The CHAIRMAN. I've been also told that if all the oil consumed in the United States each day—51 percent consumed by passenger cars, 12 percent by trucks, buses, and trains, 7 percent by aircraft, 24 percent by industry, and the rest, different places. Does that make sense?

Admiral BARRETT. Senator, I—we're obviously more focused on transportation, but, in response to your first question, my understanding is, about—something a little less than 40 percent of our supply comes from domestic sources, and the remainder comes from overseas. And I don't know how to characterize it. I don't have any information on the nature of the places we get it. But, obvi-

ously, Congress, certainly the Administration, is focused on energy security and energy independence; it's a fundamental issue for the country.

With respect to transportation, what I would offer you is that about 95 percent of the fuel used in transportation is based on petroleum in one form or another. There are some amounts that come from the power grid—electric, on rail—and there's some amount—some small amount comes from natural gas—power compressors. So, the net is that our transportation systems are heavily reliant on fossil fuel, and obviously the supply of that fuel to the effectiveness of our transportation networks and our economy is vitally important.

The CHAIRMAN. I've been told, by responsible people, that all of the major automobile manufacturers in the United States are prepared to build automobiles that will run on alternative fuel once we determine what that alternative fuel is to be. Now, if we look at articles, you'll see one organization advocating electricity; another, hydrogen; another, biofuel; one says do what Brazil does, raise sugar cane; others say corn, et cetera. But yet, at the same time, automobile manufacturers say, "If we decide, will we have distribution points?" At the present time, less than 1 percent of our gas stations provide other-than-petroleum sources. What's the solution?

Admiral BARRETT. Senator, thank you.

I—from a transportation perspective—again, to go back to your initial entry point, on the fuel price—market forces dramatically will affect the transportation systems, and also what types of alternatives. Obviously, Congress and certainly the Administration are promoting alternate fuels, renewable fuels, new technologies, different technologies, battery technologies, hybrids, clean diesel, more efficient diesel, a multitude of initiatives. And I don't think that the market has settled out, in terms of what the American consumer will find most efficient and affordable and functional for their transportation needs. And I think part of what has to happen is, as manufacturers in the marketplace bring these technologies forward, I think the—both the opportunities and the challenges associated with them in the costs will surface. And I think the market will be in the best position to help sort this out over time.

I think, obviously, from our perspective, we have ratcheted up, substantially, the mandated fuel economy standards. As you know, in April we proposed new CAFE standards for passenger cars and light trucks. That will increase—require an increase, if the rules are adopted, of 25 percent in the fuel economy of the major U.S. vehicle fleets by 2015. That would save you somewhere in the order of 521 million metric tons of CO₂. That's a very aggressive standard. It exceeds what Congress set down in the Energy Independence and Security Act. Congress mandated about a three-and-a-half-percent-a-year improvement. The Administration's initial target was about 4 percent, and the rule we've proposed is about 4 and a half percent. And how the manufacturers get to that standard, I believe, will be a combination of the types of initiatives you spoke about. And I think the market will lean toward the most effective ones at the end of the day.

The CHAIRMAN. I've been further advised by economists that the hike in price is not under the control of the marketplace; the marketplace supply-and-demand theory has very limited impact. Speculators, maybe, account for about 10 percent of the hike. And nowhere can anyone suggest that the cost of production has gone up that high. So, somebody's making a ton of money. Is that assumption correct?

Admiral BARRETT. Mr. Chairman, I think what clearly has gone on is, the demand, globally, has gone up dramatically over the past several years, not just in the United States—this is a global market; it's gone up dramatically in places like China, it's gone dramatically up in places like India, it certainly has increased in this country, as well.

So, again, to the best of our knowledge, this is fundamentally driven by supply and demand. And that's why, candidly, you know, the solution to this problem is—we hear lots of alternatives—we, kind of, have to do everything. We've got to increase domestic supplies. We've got to drive more efficient vehicles. We've got to make our systems more efficient. We've got to take a different look—I know this Committee will—at transportation, and more flexibility in transportation funding. You know, the vehicle miles traveled in April of this year are down substantially from where they were last year, driven by the prices you mentioned. And also, transit ridership is going up. People are shifting their choices, if you will, in response to these market pressures. And so, I think we need a multifaceted approach, and obviously we're going to work, and continue to work, very hard at that.

But, to the best of my knowledge, sir, this is primarily driven by supply and demand over an extended period of time. This is not new; it's just—there's less margin, there's less flexibility. We're getting up to the, kind of, limits of what the available supply is, and we need to think very seriously about expanding that supply, particularly domestically, as you mentioned, in areas such as offshore or areas such as ANWR. We need to think very seriously about that, and improve our supplies.

The CHAIRMAN. I thank you very much.

Vice Chairman Stevens?

Senator STEVENS. Senator Kerry was here ahead of me.

The CHAIRMAN. Mr. Kerry?

**STATEMENT OF HON. JOHN F. KERRY,
U.S. SENATOR FROM MASSACHUSETTS**

Senator KERRY. Admiral Barrett, I'm a little surprised, first of all, to hear you extolling the Administration's initiative with respect to CAFE standards, since the Administration fought them every step of the way and the level we're going to is well below what most of us believe we ought to be going to. And I wonder if, since your own figures on the savings and the standards were calculated on a \$2.25 price—whether now that doesn't have to be completely revised, since we're almost double that.

Admiral BARRETT. Senator, our prices were calculated based on the information provided by Department of Energy, the standard package prices that the Government uses. But, candidly, the mandate we have in the law was to address the most feasible possible,

given technology availability, as well as, you know, the art of the possible and 18-month cycles in advance for manufacturers to adjust their times, and also the cost.

Senator KERRY. What do you—

Admiral BARRETT. The cost—

Senator KERRY.—mean by the “art of the possible”?

Admiral BARRETT. In other words, the technology has to be available—

Senator KERRY. Well, the National Academy of Sciences says it is, you could double it now.

Admiral BARRETT. Not speculative. I mean, it can’t—there’s also a huge cost factor. The cost of the standards we—

Senator KERRY. Come back to the—

Admiral BARRETT. Yes, sir.

Senator KERRY.—to the expectations. I mean, the National Academy says that a lot of people out there—you can get 170 miles to a gallon tomorrow if you use a battery and plug-in and hybrid.

Admiral BARRETT. Well, and I think the manufacturers are trying to bring those forward. But, I don’t think—

Senator KERRY. Do you think the market is moving fast enough to respond to that?

Admiral BARRETT. I think it’s moving very—I think it’s moving increasingly rapidly.

Senator KERRY. And—

Admiral BARRETT. And I think you’ll see more increase in that. And—

Senator KERRY. Do you think we’d be better off if the market moved faster?

Admiral BARRETT. I think the market is moving faster—

Senator KERRY. Do you think we’d be better off if the market moved faster?

Admiral BARRETT. I think the market will move in line with the technology. I just—

Senator KERRY. No. No, no, no.

Admiral BARRETT. There’s a cost—

Senator KERRY. Would we be better off as a country if the market moved faster?

Admiral BARRETT. Well, I think there are tradeoffs. The cost to the consumer, of what we have proposed—not anything further, as you discuss; what we have proposed—is somewhere between \$300 and \$900 a vehicle. That’s substantial impact, also, that needs to be factored in.

Senator KERRY. But we—

Admiral BARRETT. I also can’t—

Senator KERRY.—we did factor it in. In 2004, I proposed a \$4,000-per-vehicle credit to the consumer.

Admiral BARRETT. Well—

Senator KERRY. That’s a worthwhile tax expenditure, isn’t it?

Admiral BARRETT. Well, it—I think that’s an issue for the Congress. I—what I also—I just—candidly, Senator, I appreciate your interest in this, and I understand the concern you’re raising. What we put out as a proposal—we’re open for comments until July 1—we will take seriously the feedback. And obviously, we will look at

what's going on in the market and what's going on with fuel as we consider a final rule.

Senator KERRY. Well, the final rule is predicated on a notion that we're going to try to achieve that standard by 2030, isn't that correct?

Admiral BARRETT. Well, it's staged, so actually a lot of the standard will be achieved by 2015, and then 2020 is the out year for the final standard—2020.

Senator KERRY. China's going to achieve that standard next year.

Admiral BARRETT. I'm not—I'm not aware of that. China has nowhere near the number of vehicles we have, either, sir.

Senator KERRY. They're growing rapidly, aren't they?

Admiral BARRETT. They are growing. But, they're still——

Senator KERRY. Doesn't it matter that they think they can put vehicles in place that can establish that standard by next year? What does that say about us?

Admiral BARRETT. Again, we've proposed what we believe is feasible and achievable, in line with the law. We've actually exceeded the requirement in the law. But, I don't know, specifically, what the Chinese——

Senator KERRY. Where's the Administration's proposal with respect to high-speed rail, and rail as a whole, in the country?

Admiral BARRETT. Well, I think rail—a number of things are going on. Certainly, freight rail is a hugely efficient way of moving freight. It's near capacity across the country.

Senator KERRY. And where's the proposal to expand capacity on high-speed rail?

Admiral BARRETT. Well, again, I think that's something that, again, is in a research-and-development area. I think Congress is obviously interested, and we are interest, also—as well. But, the technology for some of the high-speed rail is enormously expensive. And unlike in some other places, we're using existing infrastructure. You know, it's—it takes a lot of work. And it would probably be feasible only in very heavily trafficked corridors.

Senator KERRY. Well, we have some of those, Mr. Barrett. We have trains today that could go 150 miles an hour, and they can't go 150 miles an hour because the Baltimore Tunnel won't allow them to, because the——

Admiral BARRETT. You're right.

Senator KERRY.—bridges won't allow them to. And you don't have any proposal whatsoever to fix those things.

Admiral BARRETT. Well, I think, again, investment in infrastructure is enormously important.

Senator KERRY. Well, of course it is. That's what I'm talking about. But, where's the proposal?

Admiral BARRETT. For high-speed rail? We——

Senator KERRY. For any of these things.

Admiral BARRETT. Well, we have proposed—we, in fact, have spent enormous amounts of money on improving transit infrastructure, improving highway infrastructure, and trying to bring market forces to bear to improve the flow, to eliminate the congestion. And I think the passengers are moving, based on those prices.

Senator KERRY. Well, I have to tell you that it's more than passing disappointing.

Let me ask you what is the guiding operative management target under which Department of Transportation, Department of Energy, and others are proceeding with respect to global climate change? This hearing is obviously on global climate change. This is the 20-year anniversary of Jim Hansen coming up here and telling us that it's happening now, 20 years ago. Now we know it's happening, even to a greater degree and faster than was predicted. I'd like to know what the operative estimate is of your Department as to where a potential, sort of, catastrophic tipping point may be, and how fast you have to respond to these infrastructure challenges.

And I do that particularly in light of the fact that there are predictions, for instance, that—just last week, *The Washington Post* ran a story headlined, “Extreme Weather to Increase with Climate Change,” and, “Our scientists now agree that the droughts are going to get drier, the storms are going to get stormier, the floods are going to get deeper with climate change.” That's a quote. They warn of more flooding, like we're seeing in Iowa today, more heavy downpours, more droughts. “In March, the Department of Transportation found that the Gulf Coast would put a substantial portion of the region's transportation infrastructure at risk. Storm surges in the Gulf Coast will flood more than half the area's major highways, almost half of the rail miles, 29 airports, and virtually all of the ports.”

So, given these predictions, which keep coming at us, under what time-frame do you believe you're operating, in terms of the infrastructure expenditures necessary to respond to these threats?

Admiral BARRETT. Senator, I think the answer is, first, you—and you highlighted it—the Gulf Coast study we did is regionally focused. With respect to transportation infrastructure, the first step is understanding the potential implications in local areas, because they vary. And a follow-on to that study will involve the East Coast. But, the impacts will be different. Gulf Coast, obviously, you've got the potential for sea level rise, temperature changes, storm intensity, all affecting the things you do. So, I think the first thing we are trying to do is understand better, and particularly regionally, what the actual implications might be so that people who repair and renew and expand transportation infrastructure, which, to a large extent, rests in the states, as well as the Federal Government, can adjust to that over time as they repair and renew and build out.

But, I think there is no timeline, specific, but we clearly need to understand what needs to be done, and, as we plan new projects—for example, we had instrumented, in the Gulf region, a cable-stay bridge when Katrina came through. We have the data from the wind-loading on that bridge, and we're trying to—and we are assessing the implications of that for bridge design across the country. And I think you will see adjustments to how we design, build, and install bridges to withstand climate better, and the impacts of climate change, whether it's increased storms or higher river levels.

And so, the technology to do this is within our capability. We will make the adjustments as rapidly as we can. But, there's no specific time. It's a serious issue, it's got our attention, and, working with the Congress, we are doing our very best to address it.

Senator KERRY. Mr. Chairman, my time is up, and I appreciate your indulgence here.

I'd just close by saying there really is a specific time, sir. Jim Hansen, who is hugely respected, first warned of this, 20 years ago, and we've been slow to respond to it. The science is only coming back stronger and more rapidly and greater. Jim Hansen has now revised—right now, today, in these days—is warning us that we have less cushion than the scientists thought when they revised the cushion from several years ago. So, it's gone from 550 parts per million of greenhouse gases, to 450, and now, they believe, less than that.

There is a time-frame here. They've said we've got 10 years to get this right. And if you're saying to us, you know, there's no time-frame, and that's, sort of, the attitude of where we are, I think this is going to be very difficult to get done. And I think it's, frankly, inappropriate, that that is where a major department, the Department of Transportation, stands today. I think there ought to be vast commitments in incentives, tax incentives, grants, expenditures to put America on a course, here, to deal with this.

Thanks, Mr. Chairman.

The CHAIRMAN. Thank you.

Vice Chairman Stevens?

**STATEMENT OF HON. TED STEVENS,
U.S. SENATOR FROM ALASKA**

Senator STEVENS. Well, thank you very much, Mr. Chairman.

I would ask that you put my statement in the record that I would have made if I had gotten here on time. I do apologize for being late.

The CHAIRMAN. Without objection.

Senator STEVENS. And I'm constrained to say that I think my friend from Massachusetts seems to think that we ought to change the world overnight. We did adopt a new CAFE standard, the first since the 1970s; and we're implementing it. China has not called in the cars that are polluting. They've set new standards for their new vehicles, if and when they get them.

I think the problem we have to deal with is the impact of some of these changes on the individual American and on our states. Our state had, as I've said in this statement, a report that the effects of climate change stand to increase our maintenance and replacement costs for public infrastructure by \$6 billion over the next 20 years. Now, we're a small state. The impact of that on the taxpayer and upon the people of our state is going to be overwhelming if we have to start meeting some immediate standards. The question has got to be, What do we do first?

Now, I applaud you, Mr. Barrett, for what you've said, in terms of the attempts that the administration is making to get people to move, across the board. Nobody can do it overnight, all at once. But, I think the CAFE standards that we've established are really a step in the right direction. We're trying to find ways to really measure the effects of alternative energies and how much we can afford to move, and how quickly we can move on those.

I would say, those people who have opposed our exploration in the Arctic of Alaska and of developing our resources offshore have

put us behind the eight ball right now. If President Clinton hadn't vetoed the ANWR bill in 1995, we would be producing an extra 2 million barrels of oil a day, and that income to our state and to our Nation would enable us to be making some of the changes that we have to make. The only way we can make them now is to raise taxes. And how do you raise taxes on people that are currently now paying for oil at \$140 a barrel instead of \$8 a barrel, which is what we paid when we completed the Alaska Oil Pipeline?

Now, Mr. Secretary, what I'd really like to know is something different, and that is, have you conferred with the people in the aviation industry? How are they going to meet these changes? The cost of aviation fuel is going up as rapidly, or more rapidly, than that for automobiles. In my state, 70 percent of the destinations in my State can be reached only by air, and we're seeing enormous change. National airline after national airline is canceling their flights to my state. We'll be isolated in another 2 years. Now, what can we do to meet the problems of these international and national airlines?

Admiral BARRETT. Senator, thank you. I think they are enormously challenged. At the same time, they are leading American industry with respect to technology. And, as I indicated in my statement, they have actually been able to improve their fuel efficiency and reduce their carbon emissions when other international airlines—EU, for example—have not been able to do it; they're moving in the opposite direction.

We clearly—one of the principal things we're doing is try to accelerate bringing forward what is commonly termed "next generation technology" to allow the management of the air traffic system that we operate—the FAA operates—to allow them to operate much more efficiency and reduce their carbon burn. We are providing grants, through our Airport Improvement Programs, to bring ground equipment forward that uses less fuel. But, aviation—a lot of the burn is in the routes, it's getting them the ability to get from point to point more efficiently. We've changed the routing in the air, we've brought forward—allowed them to space—safely, I might add—closer together at certain altitudes. We have worked closely with the Department of Defense to open up military airspace as part of the national airspace when we've had holiday traffic. Again, it reduces the fuel burn to the airlines. We're working very closely with them to try and do everything we can to minimize the burden the Government puts on them, in terms of managing their flight profiles.

And—but, I don't want to underestimate it. Their model, their business model of your major carriers is not built on 135-dollar-a-barrel fuel, and it's a substantial challenge. And we're going to move, again, as quickly as we can. The FAA certainly is.

As an example, one of the issues we're working with the—with RNAV—and you're familiar with these, Senator—continuous-descent approaches to allow airlines in—where we can do it safely—to come down on a direct approach, basically throttle back into an airport. FAA is moving testbed into Florida to bring this forward. We've done tests in Louisville to work incrementally to reduce the fuel burn. It's that simple. There's a direct line between fuel burn and carbon footprint and cost.

Airlines are offloading weight, as you know. We're managing that for safety. That's another concern. As these things are taken—as these measures are taken, we're working very closely with them to make sure their flying remains as it is, a very safe mode of transportation.

Senator STEVENS. Well, that's good. I'm glad to hear it.

Have you analyzed the effect of cap-and-trade legislation on building our enormous natural-gas pipeline to Alaska?

Admiral BARRETT. Not specifically, no. But, I would say that cap-and-trade—we've done a couple of things in the Department. We have tried—for example, Pipeline Safety Administration—to look at ways to move gas through lines at higher volume and get more efficiency out of an existing line; move more—increase the capacity.

But, cap-and-trade, with respect to transportation systems, has to be approached very carefully. Mobile sources and sources that move product are not the same as power plants. And, again, the cost structure of the business models are totally different. And if we are not very careful about improving—and we're global—if we impose, carelessly, cap-and-trade regimes in transportation, it can have a very negative, even devastating effect. So, we haven't looked specifically at your question. I'd be glad to, and provide some feedback to you.

Senator STEVENS. Well, I wish you would, because I was told that the application of cap-and-trade, the credits that would be required during the construction phase alone for a pipeline of that size, really, it would be the largest project in the history of the United States financed by private capital—that, for all the trucks and everything else that are going to be used in this construction phase over a period of 5–6 years, that the costs would be increased by at least 20 percent if they had to go out and buy credits under that concept for the pollution that's taking place, notwithstanding the fact that the completion of the line would bring about the delivery of an enormous amount of new additional natural gas, which is not as polluting as the coal that people are using in many of the areas that would be supplied. There doesn't seem to be any leeway for those who want to move to try and get a more efficient type of energy available. I think that cap-and-trade legislation would kill that pipeline.

Admiral BARRETT. Sir, no, I agree, in general. Cap-and-trade in transportation is very treacherous and needs to be looked at very closely.

Senator STEVENS. Thank you very much.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you.

Senator STEVENS. I do have some questions to be submitted to—I'm going to be going out of the hearing after—

[The prepared statement of Senator Stevens follows:]

PREPARED STATEMENT OF HON. TED STEVENS, U.S. SENATOR FROM ALASKA

The effects of climate change on the transportation sector is an important issue, particularly in Alaska, and I thank the Chairman for holding this hearing.

The University of Alaska recently released a report on potential impacts of climate change on transportation and public infrastructure in Alaska. The report found that the effects of climate change stand to increase maintenance and replace-

ment costs of public infrastructure in Alaska by up to 20 percent, or an additional \$6 billion over the next two decades.

We can mitigate these impacts and reduce costs through study and research on improving the planning, design, construction, and operation of transportation systems.

We must also explore the potential for increased energy efficiency and reduced greenhouse gas emissions in the transportation sector. Recently, I have supported legislation to increase the corporate average fuel economy standards for automobiles.

Conservation measures and alternative energies need to be part of our long-term strategy, but the idea that we can transition from fossil fuels anytime in the next 20 years is not realistic.

Worldwide oil demand is expected to increase to 116 million barrels a day by 2030. We do need to explore ways to ease our dependence on fossil fuels in the transportation sector, but the investments required to make this transition are enormous.

This is why I continue to argue that revenues from new domestic sources of oil, including ANWR, should be devoted to climate change adaptation and alternative energy development to reduce our dependence on foreign oil.

I welcome our witnesses today, including Mead Treadwell who has traveled all the way from Anchorage to be here, and I look forward to your testimony.

The CHAIRMAN. Without objection, so ordered.
Senator Carper?

**STATEMENT OF HON. THOMAS R. CARPER,
U.S. SENATOR FROM DELAWARE**

Senator CARPER. Thank you, Mr. Chairman.

To our witnesses, welcome. Thank you for joining us today, for your testimony, and for responding to our questions.

I just want to follow up on a couple of comments that our colleagues have made in some discussion a bit earlier on CAFE. The CAFE legislation, which I think all of us here worked on to enact, has the practical effect of, not literally but figuratively, removing about 60 million vehicles off of our roads, in terms of reduced CO₂ emissions, by 2020. That's no small accomplishment. If we don't figure out how to drive less, though, instead of how to drive more, it will be an accomplishment for naught.

We were speculating earlier about whether or not we needed to go further than CAFE, further than 35 miles per gallon by 2020. My guess is that market forces will get us there a lot faster than the legislation that we've passed. And I think that will be a good thing.

I have a couple of questions, and I have a statement for the record, if I could, more effective, but a couple of questions.

Senator CARPER. And the first question, I think I'll direct it to Dr. Peterson to start off with and others might respond, if they wish. The transportation sector is responsible, I believe, for almost one-third of our greenhouse gas emissions, making it among the largest source in our economy; I think, second only to power plants. How should the U.S. surface transportation policy be updated to support the goals of climate change legislation?

Dr. PETERSON. Thank you for the opportunity to respond to that question, but it's somewhat out of my area of expertise. We've been focusing on how climate change will impact transportation, rather than focusing on how transportation is impacting climate change and what should be the change in policies should be with regard to transportation.

Senator CARPER. Let me ask a slightly different question, but a related one. Should the transportation sector be responsible for one-third of the emission reductions for CO₂ that are necessary to meet targets that scientists say is necessary?

Dr. PETERSON. Should transportation be required for one-third of the reductions or a different amount? Again, that's out of my area of expertise. But, as we look forward—

Senator CARPER. Once, in another hearing, I asked a witness a question like that, and it was beyond his area of expertise, and he just said to me, "Next question?"

[Laughter.]

Senator CARPER. You can—

Dr. PETERSON. Next question?

[Laughter.]

Senator CARPER. Let me just bounce that same question off of Mr. Barrett.

Mr. Barrett, you want to take a shot at that, and we'll give Dr. Peterson a pass, here.

Dr. PETERSON. Thank you.

Admiral BARRETT. Senator, thank you very much. And I'd agree with your observation, by the way, that the market does—seems to be working. And as gas prices are going up, we are seeing shifts in behavior that affect—and, over time, will affect even more—transportation.

But, I think—one way to approach it is, I think we clearly recognize it and desire to reduce the greenhouse gas emissions that comes from transportation. We can improve the energy efficiency of transportation vehicles, such as with CAFE. We can substitute energy sources that are lower in emission—alternate fuels, renewable fuels. We can do things, like we're doing with congestion pricing, that improve the flow—better technology, signal timing—that leverage the systems we've got; and then reduce, you know, how much motorized activity goes on—vehicles—and how much.

But, the intermodal piece is important, too. I mean, you're seeing shifts to rail, to ships, to ways that are intrinsically more efficient, and the market is driving that. I don't know if that's what—responsive. But, I think the goal is to drive it down, across the board.

Senator CARPER. I take the train back and forth to Washington almost every day. I live in Delaware and I don't get off the train at BWI, but if I wanted to, I could literally take a bus from my house to the train station, catch the train, take the train to BWI, get off, take a shuttle to the terminal, and then fly to just about any place around the world. We don't always make it easy for people to get from a train to an airport terminal, but we do at BWI, and I think we do the same thing at Newark, Delaware.

Let me just do a follow-up, if I can, Mr. Barrett. I think, in your testimony, you talked about congestion pricing, and you mentioned it just a moment ago, as well, and other travel demand management techniques, and I missed your statement, but I believe you may have cited Germany's experience with this. But, as I'm sure you know, Germany has invested a lot of money in transit. They've invested a fair amount of money in other driving alternatives that are not always available in American communities, like what I described for my own community for myself if I wanted to fly out of

BWI. But, without the safe, convenient driving alternatives, do people really have the kind of options that they need, other than, in some cases, paying the tolls, or, in other cases, changing the time of their commute, which they might like to do, but their employers may have another idea about that? And doesn't this severely limit the potential benefit of congestion pricing, which, frankly, I still find is an interesting option, but it's not without its problems?

Admiral BARRETT. No, I think it—one of the options it does is potentially does create funds to invest in other alternatives. You mentioned Germany, but if you look at London or you look at Stockholm, you look at some of the other examples where they've put, for example, cordon-type pricing approaches in, one of the things they do with the funds they gain is invest it to improve transit and improve the alternatives that you're speaking about, so that, you know, ultimately, the publicly has more choice available to them. And certainly, I think the idea of providing more flexibility to both State and local officials as they make those regional investment decisions is important.

Senator CARPER. All right. Thank you.

This could be a question for any of our panelists, but transit agencies across the country are struggling to meet the increasing demands resulting from high gas prices. This is actually a good-news story, I think, because we've seen SEPTA ridership growing in my own region of the country, by 5 to 10 percent; we've seen some transit agencies with as much as 20–25 percent growth in ridership. Ridership on Amtrak is up, I think, this year to date, by about 10 to 15 percent; last year, it was up by close to 10 percent, as well. But, transit agencies across the country are struggling to meet increasing demands resulting from high gas prices, as you know. And, at the same time, more people are turning to transit as a clean, affordable way to travel. In fact, the typical public transportation user, on average, needs to buy, I'm told, about half as much gasoline as a person without access to transit. And I would just ask anyone on this panel, is the Federal investment in public transportation adequate to serve our public in an era of high gas prices?

Dr. Turner, I can tell you're dying to answer that question.

[Laughter.]

Dr. TURNER. Well, sir, your perceptive powers are amazing.

[Laughter.]

Dr. TURNER. This is a little bit out of our area of expertise, but let me just describe for you the things that we're doing at NIST.

We're basically attacking this at three levels, starting with the atmosphere. We are working with NOAA, which is a sister agency of ours within the Department of Commerce, to make very accurate measurements of the gases that are in the atmosphere, to help with calibrating satellite instruments and to make very accurate measurements of the solar radiance on the atmosphere, and also to look at the impact of aerosols, because NOAA needs that information to put into their climate models to make the predictions that are necessary.

We're also looking at some very near-term things, such as biofuels and hydrogen as alternatives in the mix that people will have. We've been very active with Brazil and the EU to develop

standards and methods of measuring, to assure that commerce can take place equitably in biofuels.

The U.S. auto manufacturers have also been a very significant user of our neutron facility, which is used to improve fuel cells, which support a hydrogen economy. We're also working to tackle the problem of embrittlement that hydrogen has on metals that would be used in a pipeline. So, we're looking at that also.

One of the other things that we're doing is to look at what can be done with respect to cement. It's something so basic, so fundamental, but it turns out that, for each ton of cement produced, you produce a ton of carbon dioxide. And so, one of the things we're looking at is the replacement of cement, in manufacturing concrete, with fly ash. Fly ash is a byproduct of electricity production, and so, any increase that we can have in the production of concrete, using fly ash as opposed to cement, would have immediate impact on the carbon footprint that's out there.

Senator CARPER. All right, thank you.

Mr. Chairman, I think my time has expired. Could I just add a quick P.S., if I may? I won't ask another question.

When I was Governor of Delaware, if we wanted to build a road or a highway or a bridge, the Federal Government paid for 80 percent of it. Eighty percent. If we wanted to do a transit investment, the Federal Government provided 50 percent of it. If we wanted to invest—if it made more sense to put in intercity passenger rail, the Federal Government provided nothing. And I'm sure we made investment decisions, that were probably wrong decisions, because of the difference in those modes of—or measures of Federal support.

Thank you.

[The prepared statement of Senator Carper follows:]

PREPARED STATEMENT OF HON. THOMAS CARPER, U.S. SENATOR FROM DELAWARE

This is a very important hearing, one that I hope will be repeated in the other committees with jurisdiction over transportation.

The transportation sector is responsible for 30 percent of this Nation's carbon emissions and growing. Yet emissions from the transportation sector can be more difficult to address than stationary sources.

This is because we have millions of tiny, mobile smokestacks manufactured by different companies, fueled with fuel from different companies and sources and operated by millions of different people with varying demands and needs.

No matter the challenge, it is an area we must address in order to meet our carbon reduction targets and we already have the tools to do so.

There are three broad areas that must be dealt with: the efficiency of vehicles, the carbon content of fuels and how much people drive. Last year, this committee took the lead in passing a bill to increase the fuel efficiency of cars from 25 mpg to 35 mpg by 2020.

We also promoted the use of alternative fuels by passing a renewable fuels standard, requiring the production of 21 billion gallons of advanced renewable fuels, also by 2020.

The final area that needs some attention is making our transportation system less congested and more efficient. This means fixing bottlenecks, intermodalism and more options to driving.

American ingenuity is going to bring us the Chevrolet Volt in the very near future—a car that will go 640 miles without needing to be recharged or filled up. There are also companies hard at work developing renewable fuels. One example is Coskata, a U.S. company that says it will be able to produce ethanol from practically any source—including garbage, plant waste and used tires—for \$1 per gallon.

Now we, in government, need to show the same amount of ingenuity and address the efficiency of the transportation system we have built.

There is much we can learn from state and local governments that have already begun to invest in alternatives to driving, saving their constituents thousands of dollars when the cost of gas goes up.

Some states and local governments have found that when transportation and development decisions are made together the whole system works better, people save money on transportation, property values rise and pollution decreases.

To support these important efforts, the Federal Government will have to work across agencies and modes of travel to find the most effective way to move people and freight.

I look forward to hearing from our witnesses, particularly from the Department of Transportation, about how we can break down these silos and find ways to make it safe and convenient for people and goods to get where they are going, whether it is by car or truck, train, plane, ship or all of the above.

We will have to address that here in Congress, as well. In the Senate, transportation is handled by three different committees—air and rail in this Committee, highways at Environment and Public Works and transit at Banking. I am fortunate enough to serve on all three.

As we develop a climate change bill and prepare to reauthorize the surface transportation program, we need to bring these three committees together to consider how to move people and goods, not just cars, trains and ships. By doing so, we can save Americans money at the pump, reduce congestion and reduce the carbon and other pollutants being emitted today.

The CHAIRMAN. There is a vote pending at this moment. Senator Nelson will ask one question, and we will stand in recess.

**STATEMENT OF HON. BILL NELSON,
U.S. SENATOR FROM FLORIDA**

Senator NELSON. We have 7 minutes left to vote, so you all are saying, with climate change, roads will buckle, bridges will wash out, railroads will be destroyed. If the seas rose 2 feet, in my state of Florida, we're talking about—what kind of investment in transportation would be thrown out the window as a result of that?

Admiral BARRETT. I would guess—surmise, substantial. But, I—again, I would take the approach—the Gulf Coast, trying to quantify specifically where those—what rail would need to be rerouted, what roads would need to be readjusted. I think you need very specific analysis at a local and/or regional level. And obviously, we're working toward that. Understanding the specific impacts is enormously important.

Dr. TURNER. Sir, one of the things that I would add is that one of our initiatives in our 2009 budget looks more broadly at making communities more disaster-resilient. This would be for water, winds, fires, and so forth.

Senator NELSON. And that's the point. In a state like Florida, where 80 percent of the population is on the coast, it's very difficult to go in and redo all of that infrastructure. And the cost is just going to be enormous. So, we'd better start figuring out something to do so that the seas don't rise.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you.

The hearing will stand in recess. We'll be back in about 10 minutes.

[Recess.]

The CHAIRMAN. We shall resume the hearing.

I've been asked by Senator Thune to submit his remarks and questions for the record. Without objection, it is so ordered.

[The information previously referred to follows:]

PREPARED STATEMENT OF HON. JOHN THUNE, U.S. SENATOR FROM SOUTH DAKOTA

Thank you Mr. Chairman, I would like to thank the Chairman and Vice Chairman for holding today's hearing on the transportation sector's impact on climate change and climate change's impact on our transportation infrastructure.

When discussing the topic of transportation's impact on carbon dioxide and other greenhouse gas emissions, we must start with the Energy Independence and Security Act of 2007.

In addition to the historic increase in vehicle fuel efficiency standards and other energy efficiency programs, this bill included an expanded renewable fuels standard.

The 2007 Energy Bill requires the use of 36 billion gallons of renewable fuel by 2022. The new RFS also includes significant requirements for lifecycle greenhouse gas emission reductions.

New corn ethanol plants must produce ethanol with a 20 percent reduction in lifecycle greenhouse gas emissions.

Advanced biofuel and cellulosic ethanol, which constitute the majority of the new RFS, must have a 50 percent reduction and 60 percent reduction in lifecycle greenhouse gas emissions relative to regular gasoline.

Mr. Chairman, this landmark piece of legislation cannot be overlooked when discussing transportation sector's impact on greenhouse gas emissions.

Moving forward, we must continue to meet the challenges of high fuel costs and greenhouse gas emissions with common sense policies that reduce emissions while keeping U.S. businesses competitive, our economy growing, and family budgets intact.

Climate Change's impact on the transportation sector:

On account of aging and outdated infrastructure, we have economic challenges that are real, tangible, and identifiable today. Many of these infrastructure challenges are going unmet.

Based on projections of population growth and government funding streams such as the Federal Highway trust, fund we know that these challenges will only grow in the future and resources will increasingly fall short of meeting these real short- and mid-term challenges.

I encourage the Committee to proceed with caution when considering proposals that allocate scarce Federal resources based on climate models or projections of weather patterns far into the future.

The CHAIRMAN. May we have a 2-minute recess?

[Recess.]

The CHAIRMAN. You are here earlier than expected.

Ms. Klobuchar?

**STATEMENT OF HON. AMY KLOBUCHAR,
U.S. SENATOR FROM MINNESOTA**

Senator KLOBUCHAR. Well, thank you so much, Mr. Chairman. Thank you for waiting. And thank you, to our witnesses.

Everywhere I went this weekend, this issue of the interaction between changes to our climate and our transportation system—confronted me from our airlines executives at Northwest Airlines, who testified yesterday about the effect on the fuel and their need to do something differently there, to a bus line, called Jefferson Bus Line, that I did an event with, and their brochures show 100 penguins getting on their bus, to show how, by using public transportation, we can reduce carbon dioxide emissions, like, 55 cars for every bus, to a very sad moment when we went to look at the floods in southern Minnesota, right on the Iowa border, and went to a very rural part of our state, where a man was driving a business owner to get a sump pump, in the middle of the night, to help his daughter, and suddenly the road just opened up and caved in. It's literally from this wall to that wall, a country road, down probably, I don't know, 10 yards, and he died in this. And we went to the site with some of the rescue workers that tried to save his life.

But, it made me think—very close to my heart—about the effect that changes in our world are having on our transportation system.

So, I know, Dr. Peterson, you talked about some of the work that might need to be done for bridges and for roads and for other things if we continue to see changes to our climate resulting in more storms and tornados and everything else. Could you elaborate on that a little bit?

Dr. PETERSON. Yes, thank you.

One of the things we're realizing, as the climate is changing, is that it is not only changing now, or has changed in the past, but that it will change even more rapidly into the future, and we need to take this into consideration as we're designing infrastructure. Some of the questions about infrastructure are a result of how long it has been in service. For example, some coastal railroad tracks were laid shortly after the Civil War, and the climate has changed. Sea level has risen since then, and is expected to continue to rise in the future. So, we need to have a continuing effort to take adaptation measures. Not only at the present time, but continuing into the future. To always try to include the latest information as we design structures to withstand the future climate as it is evolving and going on.

Senator KLOBUCHAR. And, of course, we, here in Congress, have a responsibility to try to figure out how to fund it, and right now we are looking at a potentially bankrupt Highway Trust Fund if we don't do something different there. And I don't expect you to give us that answer, but it's clearly, as I hear about the adaptations you think that we need, that we're going to have to look at more infrastructure funding.

Have you looked, also, at the effect on the Great Lakes? Because, with the exception of this year, over the past 80 years we've seen Lake Superior at its lowest level—it's still low now, it was just lower the year before—due to climate change, because the water is evaporating. It's different than the sea. The ice melts quicker, the water evaporates, and the water levels are going down, so we're having severe problems with barge traffic coming in.

Dr. PETERSON. Yes, as the ice recedes and there is less ice, there is more evaporation with a general trend towards more drying in the midsection of the continent. We were just working on a figure, last week, of Great Lakes water levels with different model projections into the future, going out to 2100, and all of the Great Lake levels were projected to decrease under all the different global warming scenarios we were looking at.

Senator KLOBUCHAR. OK. Thank you. I just wondered if that was unique to our lake.

And then, I wanted to turn to—Mr. Deputy Secretary, to some of the issues of the biofuels, which both you and Dr. Turner mentioned. And we are one of the leading states for biodiesel, were ahead of our time on ethanol, and are now ahead of our time, in terms of looking to that next stage of ethanol, which is cellulosic, with prairie grass and—I've seen plants in my state. Guys have laptop computers showing how we can grow it on all the highway medians. And my husband and I wonder how we're going to harvest it. It looks a little dangerous. But, the point is that there are all kinds of possibilities to go into this next stage of ethanol, and

I just wondered what you see as the potential of biofuels if we go beyond where we are now with corn?

Admiral BARRETT. Senator, thanks. Obviously, alternative and renewable fuels are something that offers some possibilities. What we are looking at is both the research and technology necessary to allow these fuels to operate safely. Safety is always our primary concern. And, as you bring ethanol, alcohol-based fuels, into transportation networks, the ability to move them and distribute them safely is a concern. So, we're investing a fair amount of research in that, and obviously working with a lot of partners.

Senator KLOBUCHAR. And I probably missed the main point. I mean, the main point, when we're talking about climate change and the interaction with transportation, is, not only is it energy-independent, but it's actually the—if done right, the prairie grass, the cellulosic is actually carbon-negative, as opposed to the corn, which reduces carbon dioxide by, I think, 20 percent over the fuel, but this could actually be carbon-negative, so it could reduce—

Admiral BARRETT. And I—in broad terms, we obviously have to make our vehicles more efficient, we have to make our systems more efficient, we have to look for alternative and renewable sources, we have to improve our supplies. I think it's multifaceted. I also think it will take time. The market will help determine how quickly it can be brought forward and how it works for American consumers and their vehicles.

Senator KLOBUCHAR. And, Dr. Turner, one of the things we're looking at is some higher blends. Let's say, we—you know, we have E85 in Minnesota, but we also—E10, E20, but we could do some higher blend of fuel, where it's part gas and then it's part biofuel, whether it's from algae or whatever we're going to develop in this country. Have you looked at that for standards for certification? I know there's also—it's—being in a big snowmobiling state of Minnesota, there are also some issues for smaller engines with higher biofuel blends that we're going to have to look at and make sure that they're still going to be able to work. But, could you talk about that? Because that could be a very promising development, if we actually up the percentage of biofuels in all of our—in all of our fuel.

Dr. TURNER. Yes, Senator. As you're aware, measurements and standards are our core competency, and we certainly are looking at that. We're also looking a bit beyond that, to look at different catalysts that may be available to make the process of producing the ethanol more efficient. Also, we are looking at the possibility of synthetic molecules that would have a greater energy content than the ethanol that's currently produced.

Senator KLOBUCHAR. Exactly.

Dr. TURNER. We're looking at things, across the board, as well as looking globally at the other countries that will be playing in the ethanol economy, to make sure that we have a level playing field and we have common terminology and common definitions and are able to trace back to common standard references for precisely what is ethanol, so that our consumers can have confidence that for each dollar they pay, they get what they think they're getting.

Senator KLOBUCHAR. And I just think sometimes this—biofuel things get very confusing for people, but it's an infant industry,

and it clearly needs to get more efficient as we go forward. But, when we look at other countries, like Brazil, they've done a lot with this, and it's possible, if we do this right, we can actually do something about climate change at the same time.

So, thank you, to all three of you.

The CHAIRMAN. Thank you very much.

Senator Lautenberg?

**STATEMENT OF HON. FRANK R. LAUTENBERG,
U.S. SENATOR FROM NEW JERSEY**

Senator LAUTENBERG. Mr. Chairman, I'll wait until the second panel comes, please.

The CHAIRMAN. OK.

Then, I'd like to thank Admiral Barrett, Acting Director Turner, and Senior Scientist Peterson. We thank you very much. Your testimony will be most helpful.

And we'll be submitting many questions. We look forward to your answers.

Our next panel consists of the Chair of the American Association of State Highway and Transportation Officials, Climate Change Technical Assistance Program, and the Secretary of Transportation of the State of Maryland, the Honorable John D. Porcari; then the Affiliate Professor of Economics, Loyola College in Maryland, on behalf of the National Research Council, Three Stratford Road, Baltimore, Dr. G. Edward Dickey; Research Director of the Clean Vehicles Program, Union of Concerned Scientists, Mr. David Friedman; President and Chief Executive Officer, American—Association of American Railroads, Mr. Edward Hamberger; Executive Vice President and Chief Operating Officer, Air Transport Association, Mr. John M. Meenan; and the Chairman of the Arctic Research Commission, Mr. Mead Treadwell, of Anchorage.

I'd like to recognize Mr. Lautenberg for his opening statement.

Senator LAUTENBERG. Thank you, Mr. Chairman. And I apologize for my late arrival.

I saw a phenomenon this morning that is almost noteworthy; and that was, I came down on an airplane that was on time. It is very unusual.

[Laughter.]

Senator LAUTENBERG. Mr. Chairman, one-third of America's greenhouse gas emissions comes from cars, trucks, and buses. And Dr. James Hansen, NASA scientist, said, just last week, and I quote, "If we don't begin to reduce greenhouse gas emissions in the next several years, then we are in trouble." And we've got to begin by getting cars off the road, more people onto passenger rail, buses, subways, and other types of mass transit. Already, more and more people are riding public transit, and it's more efficient, more convenient, and, with these high gas prices, certainly more affordable.

Now, as all know, gas has skyrocketed in price from \$1.50 a gallon in 2000 to more than \$4.00 a gallon today. And that's why, in the first 3 months of this year, the number of people taking mass-transit options rose more than 3 percent, just in the first 3 months, over the same period last year. And I'm a user of trains on a regular basis, and it's just more and more crowded, people jamming the cars and the stations.

Amtrak also set records last month, both in number of riders and amount of revenue. And the Lautenberg-Lott Amtrak bill, which we hope to finalize soon, and send to the President for his signature, will lead to even more rail options for travelers. But, for travelers who still need or choose to drive, we must continue improving the fuel economy of our cars and trucks.

Last year, we took the historic step of increasing the fuel efficiency of our vehicles for the first time in decades. But, that same day, the Bush EPA denied a waiver to allow California, New Jersey, and 14 other states to set fuel economy at even the higher standard of 40 miles a gallon by 2020. Now, if this waiver were granted, it would take the equivalent of more than 6 million cars and trucks off the road. Congress must act to overturn the President's action.

We've also got to act to ensure more efficient movement of freight. Trains are at least six times more energy efficient than trucks, and barges are more than eight times more efficient. I chaired a Subcommittee hearing a couple of weeks ago on freight transportation needs, and, based on what I learned, I plan to introduce tax relief legislation which will encourage greater use of ships and barges, or, as we call it, short sea shipping between U.S. ports. By investing in fuel efficiency, mass transit, and better freight strategies, we can both bring relief to the people at the pump and fight global warming for generations to come.

And I thank you, Mr. Chairman, for permitting me to go out of order.

The CHAIRMAN. Mr. Lautenberg, will you yield?

I regret I must leave this hearing. And so, I will be relinquishing the chair to Senator Lautenberg.

And I thank you very much, members of the panel. But, I have two other meetings to attend. So, thank you.

Senator LAUTENBERG [presiding]. Thank you, Mr. Ex-Chairman. [Laughter.]

Senator LAUTENBERG. I don't do this lightly.

We welcome the panel, and I'm pleased to be here with my friend Senator Stevens from Alaska. You heard the Chairman bring in the list of our panel, and I'm pleased to have you all here. And I would ask that you give your testimony.

And, unfortunately, because of the size of the panel, we're going to be fairly strict in the limit of 5 minutes, so we ask you to summarize your testimony.

And, if you would, first, Mr. Porcari.

**STATEMENT OF HON. JOHN PORCARI, SECRETARY,
MARYLAND DEPARTMENT OF TRANSPORTATION; CHAIR,
CLIMATE CHANGE TECHNICAL ASSISTANCE PROGRAM
ADVISORY BOARD; AND CHAIR, STANDING COMMITTEE ON
AVIATION, AMERICAN ASSOCIATION OF STATE HIGHWAY AND
TRANSPORTATION OFFICIALS**

Mr. PORCARI. Thank you, Mr. Chairman and members of the Committee.

I'm John Porcari, Secretary of the Maryland Department of Transportation, and I'm here on behalf of the American Association

of State Highway and Transportation Officials in my capacity as Chair of the Climate Change Technical Assistance Advisory Board.

And let me say that, first, the State DOTs are working to be part of the climate change solution. As you have noted, transportation represents approximately one-third of greenhouse gas emissions, and it's estimated that highway vehicles generate 72 percent of those emissions.

To make a positive contribution to the issue of global climate change, AASHTO believes transportation policies need to reduce dependence on foreign oil, reduce energy consumption, and reduce travel demand relative to current trends. To achieve these goals, AASHTO has called for reducing oil consumption by 20 percent in 10 years, doubling the fuel efficiency of new passenger cars and light trucks by 2020, in the fleet by 2030, and reducing the growth of vehicle-miles-traveled from the predicted 2 percent per year to 1 percent per year.

To reduce vehicle travel, AASHTO has endorsed doubling transit ridership by 2030, significantly expanding the market share of passengers and freight moved by rail rather than trucks, reducing the percentage of commuters who drive alone to the 1980 levels, and increasing the percentage of those who ride transit, carpool, walk, bike, and work at home.

Additionally, we're utilizing a publication we call the "AASHTO Transportation and Climate Change Primer" to outline, for State and industry transportation leaders, the current thinking on climate change and transportation.

We have also initiated a climate change technical assistance program to supply states with timely information, tools, technical assistance, and assistance in meeting climate change challenges.

Let me briefly turn to the points that we believe should guide Federal policy in this area.

First, the challenge before us is to reduce total greenhouse gas emissions worldwide. We need to develop national policies that reduce our own emissions, and, where possible, contribute to the broader global effort to reduce emissions.

Second, reducing greenhouse gas emissions worldwide will require a major contribution from every country and every economic sector, including transportation. No one can sit on the sidelines. Transportation agencies stand ready to do our part.

Third, reducing greenhouse gas emissions will involve many separate initiatives. In the transportation sector, we need improvements in fuel economy, greater usage of low-carbon fuels, better management of our transportation system to reduce congestion and smooth traffic flows, and we need to take steps that reduce the growth in vehicle miles traveled.

Fourth, we should focus on finding solutions that yield the greatest emissions reductions at the lowest cost. In other words, cost-effectiveness should be a major consideration in setting policy.

Fifth and finally, we need major technological breakthroughs in order to have any chance of dramatically cutting global emissions of greenhouse gases. For transportation, this means improvement of fuel economy, but ultimately a transition to entirely new fuels and new propulsion systems.

With these breakthroughs and significant reductions, we believe we can still allow for the travel growth to support the economy.

In recent decades, road travel has greatly increased, while the emissions of many harmful air pollutants have been significantly reduced. Technological innovation has made this possible. Reducing greenhouse gas emissions presents a new challenge, and technological advances will be just as important.

We're also seeing a tempering of growth in travel, due, in part, to the higher fuel prices. Rather than growing at 2 percent or more annually, we've seeing the average vehicle-mile-traveled growth of one-half of 1 percent since 2004.

Recently, USDOT reported the cumulative vehicle miles of travel for 2008 declined by 2.1 percent. It's feasible, through a combination of measures, to achieve major reductions in greenhouse gases from road travel in the U.S. Relieving traffic congestion is also essential to reducing greenhouse gas emissions. The optimal speed for motor vehicles is about 45 miles per hour. At lower speeds, emissions are several times higher. If we can reduce the fuel burned by vehicles stalled in traffic, that is a gain. If we can improve the flow of traffic so fuel is burned at a more optimal efficiency, that will also produce a gain.

In my own State of Maryland, under the leadership of Governor Martin O'Malley, we've developed a statewide greenhouse gas emissions and carbon footprint reduction strategy. Our goal is to reduce emissions between 25 and 50 percent by 2020, and to obtain a 90-percent reduction in greenhouse gases by 2050. Those transportation policies that will help implement this include: slowing the growth of VMT, supporting the development and use of improved techniques and fuels, and examining other strategies, such as promoting sustainable transit communities and transit-oriented development.

We're also evaluating what climate change and sea level rise will mean to our transportation infrastructure, given that Maryland has 4,360 miles of shoreline. Now, fortunately, as a multimodal State DOT with one transportation trust fund for highways, transit, ports, and airports, we can work across the board to meet these goals.

Thank you for the opportunity to testify.

[The prepared statement of Mr. Porcari follows:]

PREPARED STATEMENT OF JOHN PORCARI, SECRETARY, MARYLAND DEPARTMENT OF TRANSPORTATION; CHAIR, CLIMATE CHANGE TECHNICAL ASSISTANCE PROGRAM ADVISORY BOARD; AND CHAIR, STANDING COMMITTEE ON AVIATION, AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS

Good morning, I am John Porcari, Secretary of the Maryland Department of Transportation. Thank you for the invitation to speak today on an issue of critical importance to the Nation—climate change and national strategies to address climate change.

I am appearing on behalf of the American Association of State Highway and Transportation Officials (AASHTO). I chair AASHTO's Climate Change Technical Assistance Program Advisory Board and the Standing Committee on Aviation. I will also touch on some Maryland activities and initiatives.

AASHTO and its members are working diligently to be part of the climate change solution. AASHTO has undertaken a number of climate change activities, including:

- Organizing a Transportation Vision Conference in Spring, 2007 which included discussions regarding sustainability and climate change;

- Publishing, in April 2008, a Primer on Transportation and Climate Change; and
- Developing a Climate Change Technical Assistance Program to supply AASHTO members with timely information, tools and technical assistance to assist them in meeting the difficult challenges that arise related to climate change.

These and other materials will be provided to the Committee staff for use by the Committee.

In May, 2007 AASHTO brought together transportation experts from across the nation, representing users, builders and providers of our transportation system for a three-day Transportation Vision and Strategies for the 21st Century Summit. The resulting report, *A New Vision for the 21st Century*, recognized the difficult challenge of expanding the transportation network's capacity to serve a growing population and communities and an expanding economy while simultaneously reducing the environmental footprint of the system. To address this challenge, AASHTO adopted the "Triple Bottom Line" approach, to encourage sustainable development by evaluating performance on the basis of social, economic and environmental impacts. The "triple bottom line" calls for:

- Robust economic growth,
- "Better than before" health of the environment, and
- Improved quality of life for all citizens.

AASHTO further recognized that to make a positive contribution to the issue of global climate change, transportation policies need to reduce dependence on foreign oil, reduce energy consumption, and reduce travel demand, relative to current trends. To achieve these goals AASHTO called for:

- Supporting the President's goal to reduce oil consumption by 20 percent in 10 years,
- Doubling the fuel efficiency of new passenger cars and light trucks by 2020, the entire fleet by 2030, and
- Reducing the growth of vehicle miles traveled from the predicted 2 percent per year to 1 percent per year.

To achieve the proposed reduction in VMT growth, AASHTO proposed:

- Doubling transit ridership by 2030,
- Significantly expanding the market share of passengers and freight moved by rail rather than trucks,
- Reducing the percentage of commuters who drive alone to 1980 levels, and
- Increasing the percentage of those who ride transit, carpool, walk, bike and work at home.

The AASHTO Transportation and Climate Change Primer was developed to provide AASHTO members with an introduction to the issue of climate change and its implications for transportation policy in the United States. The paper is organized into five parts:

- *Part I summarizes the current state of scientific knowledge concerning the causes and impacts of climate change.*
- *Part II provides an introduction to climate change policy issues.*
- *Part III discusses trends in greenhouse gas emissions from road transportation.*
- *Part IV reviews potential measures to reduce greenhouse gas emissions from road transportation.*
- *Part V identifies issues for further study.*

The Primer is based on the most recent research in the field. Its purpose is to outline for AASHTO members the current thinking of governmental agencies, researchers, and advocacy groups on the issue of climate change and transportation.

General Observations

In my testimony today, I will focus on the issue of climate change as it relates to the surface transportation system, specifically highways. I will begin with a few general points that we believe should guide Federal policy in this area.

First: The challenge before us is to reduce total greenhouse gas emissions, worldwide. In the end, it is the global total that matters. This means we need to develop national policies that reduce our own emissions and, where possible, contribute to the broader global effort to reduce emissions.

Second: Reducing greenhouse gas emissions worldwide will require a major contribution from every country and every economic sector, including transportation. No one can sit on the sidelines and wait for others to carry the burden. As transportation agencies, we stand ready to do our part.

Third: The effort to reduce greenhouse gas emissions will involve many separate initiatives. There is no silver bullet. We should not get so caught up in debates about competing approaches that we lose sight of this bigger picture. In the transportation sector, this means we need improvements in fuel economy; we need greater usage of low-carbon fuels; we need better management of our transportation system to reduce congestion and smooth traffic flows; and we need to take steps that reduce the growth in vehicle miles traveled (VMT).

Fourth: We should focus on finding solutions that yield the greatest emission reductions at the least cost. In other words, cost-effectiveness should be a major consideration in setting policy. Congress will be asked to consider many proposals in the name of climate change. The question that must be asked is: How much emissions reduction will this policy deliver, and at what cost?

Fifth, and finally: Technological innovation has been the key to environmental progress in many areas. That will be even truer with greenhouse gas emissions. Quite simply, we need major technological breakthroughs in order to have any chance of dramatically cutting global emissions of greenhouse gases. For transportation, this means not only improvement in fuel economy, but ultimately a transition to entirely new fuels and new propulsion systems—for example, plug-in hybrid vehicles, zero-emission fuel-cell vehicles, and large-scale use of next-generation renewable fuels such as cellulosic ethanol.

Trends in Greenhouse Gas Emissions from Road Travel

According to the policy analysis seen to date, transportation represents approximately one third of greenhouse gas emissions, and it is estimated that highway vehicles generate 72 percent of those emissions.

Between now and 2030, the U.S. Government forecasts that fuel efficiency will continue to improve and renewable fuels will gain market share, but also vehicle miles traveled (VMT) will continue to grow at 1.6 to 1.9 percent annually, outpacing the gains in fuel efficiency. The result is that, according to DOE's forecasts, greenhouse gas emissions from the transportation sector are projected to increase gradually between now and 2030.

Clearly, it is important to find ways to reduce greenhouse gas emissions from the U.S. transportation system, but how? It is a difficult challenge, but the challenge can be overcome. Recently, AASHTO published a report—the "Primer on Transportation and Climate Change—which analyzed this issue.

The Primer developed four scenarios showing how much greenhouse gas emissions could be reduced under a range of assumptions about fuel economy and growth in vehicle miles traveled. These scenarios assumed that fuel economy would increase faster than currently forecasted by USDOE—increasing to 50 or 100 miles per gallon in 2050. (For this study, "miles per gallon" was measured in "gasoline equivalent", which is a measure that converts greenhouse gas emissions from electric or hydrogen fuel-cell vehicles into an equivalent amount of gasoline usage). The scenarios considered in the primer also assumed the VMT would grow at either 1.5 percent or 1.0 percent annually, which would be slower than the USDOE's forecasts. AASHTO found that under these scenarios, major reductions in greenhouse gas emissions are achievable—in the range of 60 to 80 percent under the more optimistic scenarios.

These scenarios are intended to illustrate the point that significant reductions in greenhouse gas emissions from road travel can be achieved, if we have major breakthroughs in fuel economy and a slight tempering of travel demand growth—while still allowing for travel demand to increase at a rate at least equal to population growth.

So is it realistic to achieve these dramatic reductions in greenhouse gas emissions?

First, in terms of fuel economy: We have all seen the tremendous increase in sales of gas-electric hybrid vehicles, which were rare up until just a few years ago. The auto manufacturers are working on developing entirely new vehicles, such as plug-in hybrids—for example, the Chevy Volt—that runs entirely on electricity. Researchers are also working on other innovations in vehicles and fuels, including next-generation (cellulosic) ethanol and hydrogen fuel-cell vehicles. The seeds of tomorrow's technological breakthroughs have already been planted.

And in terms of vehicle miles traveled: The VMT growth trends have been tapering off in recent years. Rather than growing at 2 percent or more annually, we have seen average VMT growth rates of approximately 0.5 percent (one-half of a percent)

since 2004. And very recently, the USDOT reported that cumulative vehicle miles traveled for 2008 declined by 2.1 percent. Higher gasoline prices have played a role in this shift, as have demographic factors. But the bottom line is this: we are not seeing runaway growth in VMT; in fact, we are seeing just the opposite. The tempering of VMT growth provides another indication that it is feasible—through a combination of measures—to achieve major reductions in greenhouse gases from road travel in the U.S.

Reducing Greenhouse Gas Emissions Through Innovation in Vehicles and Fuels

In recent decades, the volume of road travel has greatly increased, while the emissions of many harmful air pollutants have been significantly reduced. Technological innovation has made this progress possible: today's vehicles are more fuel-efficient and employ far more sophisticated emissions-control technologies than those on the roads in the 1970s. Reducing greenhouse gas emissions presents a new challenge, and in some ways a greater one. But technological advances will be just as important to meeting this challenge as they have been to achieving environmental goals in the past.

As the AASHTO scenarios illustrate, technological innovation is essential to achieving emissions reductions. There are several ways that Congress can help encourage innovation in vehicles and fuels. I will briefly cover several of the most important ways that Congress can assist in this area.

Strengthening Vehicle Emission Standards

In 2007, Congress increased the CAFE standard for passenger vehicles and light trucks to 35 mpg, which must be achieved by 2020. The law also creates a framework under which CAFE standards may further increase between 2021 and 2030 for passenger cars and light trucks, and establishes a program under which fuel-economy standards will be set for medium-duty and heavy-duty trucks. There could also be separate legislative or regulatory initiatives to continue raising fuel-economy standards, as a way of making continued progress toward reducing greenhouse gas emissions despite increasing travel demand.

In addition, California and several other states have adopted stricter vehicle emission standards than those established by the Federal Government. However, these standards cannot take effect unless a waiver is granted by EPA, and in December 2007, EPA denied the waiver. California and other states have filed a lawsuit to overturn the waiver, and that case is now pending. If the California standards are eventually allowed to proceed, or are adopted in some form at the Federal level, they will contribute to further reductions in greenhouse gas emissions.

Researchers have suggested another regulatory option, which focuses specifically on greenhouse gas emissions. This concept involves setting greenhouse gas emission standards for vehicles—that is, a standard for the grams of greenhouse gases emitted per mile of travel. This type of standard would more precisely reflect the underlying goal of reducing greenhouse gas emissions, not just reducing the amount of fuel consumed. This standard could be defined so that it covers all greenhouse gases emitted by vehicles, including methane and nitrous dioxide, not just CO₂.

Low-Carbon Fuel Standards

Federal legislation has set goals for the total amount of biofuels to be produced in 2022 (36 billion gallons), but has not set an overall goal or requirement for reducing the carbon content of transportation fuels. However, California has adopted a low-carbon fuel standard, which calls for a 10 percent reduction in the carbon intensity of transportation fuels by 2020. Additional states, and possibly the Federal Government, could adopt low-carbon fuel standards in the future. If such standards are adopted, it will be important to consider the life-cycle emissions of greenhouse gases associated with each fuel. Some of the benefits of using low-carbon fuels may be offset by the additional greenhouse gas emissions that result from clearing land and growing crops to produce the fuels.

Cap-and-Trade Program/Carbon Tax

Any system for pricing carbon (whether it involves a cap-and-trade program or a carbon tax) could include transportation fuels. For the consumer, the increased cost of carbon would show up in the price of gasoline at the pump. Estimates differ about how much a system of carbon pricing would affect gasoline prices. However, there is general agreement that the effect on gasoline prices would be noticeable but not dramatic in relation to the price increases that have occurred in recent years.

The enormity of the potential revenues from a carbon tax or cap-and-trade program would give rise to important policy decisions about how to spend those revenues and whether to make offsetting tax cuts. Certainly, there would be a strong

policy preference for funding activities that help to reduce greenhouse gas emissions, such as increased investments in transit, better management of our transportation system to reduce congestion and smooth traffic flows, and removing barriers to high density development. Congress should also consider dedicating a portion of the revenues from such a program to help meet the costs of adapting to climate change, including the costs of adapting the Nation's transportation infrastructure.

Reducing Greenhouse Gas Emissions by Reducing the Growth in Vehicle Miles Traveled (VMT)

While technological change is essential to reducing greenhouse gas emissions, there is also a role for strategies that help to limit the growth in travel demand. As discussed above, the total VMT has grown much faster than population growth for the past several decades, but appears to have slowed considerably in the past few years. The average annual increase in VMT between 1990 and 2005 was approximately 2.2 percent. By contrast, population increased only about 0.8 percent per year during this period. Between 2005 and 2007, VMT growth occurred at a much slower rate—approximately 0.5 percent annually. Recent reports indicate that over the 12 month period between March 2007 and March 2008, VMT declined by 4.3 percent.

This recent data suggests that the VMT growth rates are moderating. It is unclear at this point whether the lower growth rates are merely a temporary departure from historical trends or a sign that future VMT growth will be much lower than in the past. Certainly, it is plausible that continued record high oil prices will cause motor fuel prices to remain high or increase, which could continue to dampen growth in VMT. In addition, changing demographics (an increase in retirees as the baby boomer generation reaches 65 years of age) could also help to reduce the rate of VMT growth, since people over the age of 65 generally drive less than the rest of the population.

There are many factors that can affect the future growth rate of VMT. Among the most important factors are economic trends and demographic forces, which are largely beyond the influence of government policies. For example, a strong economy and rising average incomes tend to produce increases in VMT; conversely, large and sustained increases in fuel prices will tend to dampen the growth in VMT.

Against the backdrop of these larger trends, government policies also can play a role—albeit a limited one—in influencing VMT growth. Strategies that can be used include: (1) increasing investments in transit and intercity passenger rail, (2) expanding other alternatives to single-occupant vehicle travel, and (3) encouraging land uses that minimize the number and length of auto trips.

Expanding Transit Service and Intercity Passenger Rail

Transit service provides an alternative to automobile travel and, under certain conditions, can help reduce greenhouse gas emissions. The challenge is how to make the most of transit's potential, given that it serves a relatively small share of travel in the United States (1 percent of passenger miles traveled) and major transit system expansions require significant public sector funding. Additional research will be required to determine how much of a reduction in total greenhouse gas emissions could be achieved through increased transit ridership and which types of transit investments would yield the greatest (and most cost-effective) reductions in greenhouse gas emissions.

While expanding transit service may not yield major reductions in greenhouse gas emissions, there are still good policy justifications for increasing investments in transit service. For example, transit service continues to play a key role in maintaining mobility within large and densely population metropolitan areas, especially for populations that lack access to an automobile. In addition, expanding transit service can facilitate higher-density land use patterns that help to reduce the need for auto trips. These considerations, in combination with the potential greenhouse gas emission reduction benefits, provide support for continuing to expand transit service as an integral part of the transportation system.

Expanding Alternatives to Single-Occupant Auto Travel

In addition to transit, passenger travel also occurs by walking, biking, carpooling, vanpooling, and telecommuting. To the extent that auto driving in single-occupant vehicles can be shifted to these alternatives, greenhouse gas reductions can be achieved. Telecommuting is likely to be a highly cost-effective strategy for reducing greenhouse gas emissions, as telecommuting costs are quite low, with potentially a net savings per ton of greenhouse gas reduction, after factoring in reduced auto operating costs.

Changes in Land Use Patterns

Land use decisions play an important role in determining the demand for automobile travel. Existing land use patterns in many areas make automobile travel a necessity for most trips. Higher-density land use patterns, combined with increased availability of transit service, could help to reduce the demand for automobile travel without reducing mobility.

A key question is how to bring about those types of changes in land use, which can be difficult because land use decisions are primarily made by local governments. Government efforts should be focused on removing the barriers to higher-density land use patterns, not regulating lifestyle changes. Example of such barriers include, local land use policies, such as zoning and parking regulations and local reliance on land use taxes which tend to make localities favor commercial development rather than residential development. In addition, efforts should be made to tie the location employment centers with affordable housing and tie high density development with transit services.

As with transit, an important question to consider is how much greenhouse gas emissions reduction can be achieved by shifting to higher-density and less auto-dependent land use patterns. This issue—the magnitude of the effect on VMT—has been addressed in several reports. These reports indicate that changes in land use can reduce VMT growth—over a 40 to 50 year timeframe—by approximately 5 to 10 percent.

Reducing Greenhouse Gases Through Congestion Relief and Other Operational Strategies

In tandem with efforts to develop cleaner vehicles and fuels and to reduce growth in VMT, it also is possible to reduce greenhouse gas emissions by reducing congestion and encouraging more efficient operation of motor vehicles.

Congestion Relief

Traffic congestion contributes to greenhouse gas emissions because vehicle engines operate less efficiently—and therefore produce higher emissions per mile—when they are driven at low speeds in stop-and-go traffic. The optimal speed for motor vehicles with internal combustion engines is about *45 mph*. At lower speeds, CO₂ emissions per mile are several times higher than at 45 mph. At higher speeds, CO₂ emissions per mile increase as well, but somewhat less sharply. As such, congestion relief can play a role in reducing greenhouse gas emissions. If we can reduce the amount of fuel burned by vehicles stalled in traffic that is a gain. If we can improve the flow of traffic so fuel is burned at more optimal efficiency rates then that will also produce a gain.

Driver Behavior

In addition to vehicles, fuels, and VMT, the way motorists actually operate their vehicles affects greenhouse gas emissions. The March 2007 TRB report notes that: Recent EAP data suggests that a significant component of greenhouse gas emissions—as much as 22 percent—results from inefficient operation of motor vehicles. These inefficiencies could result from factors beyond the driver's control, such as traffic congestion, and also could reflect a driver's own behavior, such as high-speed driving, vehicle maintenance, and tire pressures. Driver education and other policies could help to promote more efficient vehicle operations, which would help reduce greenhouse gas emissions.

The Impacts of Climate Change on the Transportation System

While my testimony today focuses primarily on the role of the transportation system in emitting greenhouse gases, I will also briefly address the Transportation Research Board's (TRB's) recent report on the potential impacts of climate change on the U.S. transportation system.

Based on numerous peer-reviewed scientific studies, the TRB report identified five climate changes of particular importance for the transportation system in the U.S.:

- Increases in very hot days and heat waves,
- Increases in Arctic temperatures,
- Rising sea levels,
- Increases in intense precipitation events, and
- Increases in hurricane intensity.

These changes in climate will affect the transportation system in many ways. The TRB report noted several specific examples. Just a few of these examples include:

- *Operational and maintenance impacts of excessive heat.* “Periods of excessive summer heat are likely to increase wildfires, threatening communities and infrastructure directly and bringing about road and rail closures in affected areas. Longer periods of extreme heat may compromise pavement integrity (e.g., softening asphalt and increasing rutting from traffic); cause deformation of rail lines and derailments or, at a minimum, speed restrictions; and cause thermal expansion of bridge joints, adversely affecting bridge operation and increasing maintenance costs.”
- *Increased flooding of coastal roads and rail lines.* “The most immediate impact of more intense precipitation will be increased flooding of coastal roads and rail lines. Expected sea level rise will aggravate the flooding because storm surges will build on a higher base, reaching farther inland. . . . [The IPCC] identifies coastal flooding from expected sea level rise and storm surge, especially along the Gulf and Atlantic coasts, as one of the most serious effects of climate change. Indeed, several studies of sea-level rise project that transportation infrastructure in some coastal areas along the Gulf of Mexico and the Atlantic will be permanently inundated sometime in the next century.”
- *Disruption of coastal waterway systems.* “[A] combination of sea level rise and storm surge could eliminate waterway systems entirely. For example, the Gulf Coast portion of the intercoastal waterway will likely disappear with continued land subsidence and disappearance of barrier islands. This will bring an end to coastal barge traffic, which helps offset rail and highway congestion; all ships will have to navigate the open seas.”
- *Impacts on Alaskan infrastructure.* “The effects of temperature warming are already being experienced in Alaska in the form of continued retreat of permafrost regions (see the discussion of Alaska below), creating land subsidence issues for some sections of the road and rail systems and for some of the elevated supports for above-ground sections of the Trans-Alaska pipeline. Warming winter temperatures have also shortened the season for ice roads that provide vital access to communities and industrial activities in remote areas.”

Several other studies have also concluded that climate change is likely to have widespread and severe impacts on transportation infrastructure. These studies include:

- *U.S. DOT Gulf Coast Study.* This study examined the potential impacts of climate change on transportation infrastructure in the Gulf Coast region. The study recognized “four key climate drivers” in the Gulf Coast region: rising temperatures, changing precipitation patterns, rising sea levels, and increasing storm intensity. It suggested a range of possible responses, including raising transportation facilities in low-lying areas; hardening them to withstand storm events; relocating them to areas that are less vulnerable; and expanding redundant systems where needed.
- *ICF Studies of Sea-Level Rise.* This two-part study focused specifically on the potential impacts of sea-level rise (not climate change in general) on transportation infrastructure. Phase 1 assessed impacts of sea-level rise on the District of Columbia, Maryland, Virginia, and North Carolina. Phase 2, which is still under way, will evaluate impacts of sea-level rise on seven additional States on the East Coast: New York, New Jersey, Pennsylvania, Delaware, South Carolina, Georgia, and the Atlantic Coast of Florida.

As these studies reflect, there is a growing consensus that climate change has already begun to have impacts on the transportation system and that those impacts will become more severe over time as the global climate continues to warm.

Adapting to climate change will present challenges for all levels of government. Rather than a single national program or strategy, there will likely be many initiatives undertaken in response to the specific climate-related threats that exist in each region.

For the transportation system, the adaptation challenges will be substantial. There is a need for adaptation planning at the State and local level, because of the important role of State and local governments in maintaining and operating the road system. According to the Pew Center on Global Climate Change, five States have adopted adaptation strategies (as of January 2008) as part of their comprehensive climate action plans, while six others have started adaptation planning efforts. In addition, cities and counties have begun to address adaptation as part of their climate plans. King County, Washington (which includes Seattle) has established an inter-departmental team to develop adaptation plans and has even produced a guidebook on this issue. New York City has addressed adaptation as part of

“PlaNYC”, which calls for planning to protect critical infrastructure and high-risk communities from the effects of climate change.

Maryland Activities and Initiatives

The Maryland Department of Transportation (MDOT) is undertaking various efforts and activities to reduce GHG emissions in Maryland, including participating in developing a statewide *Greenhouse Gas and Carbon Footprint Reduction Strategy* (GHG Strategy) and promoting sustainable transit communities. MDOT is also active in evaluating what climate change and sea level rise will mean to our transportation infrastructure given Maryland’s 4,360 miles of tidal shoreline and our transportation system’s proximity to these areas.

In April 2007, Governor Martin O’Malley established a Climate Change Commission through Executive Order that includes: sixteen agency heads, six members of the General Assembly, private sector representatives from environmental groups and power companies, and local government representatives. This Commission is charged with:

- Developing a plan of action to address climate change;
- Preparing for climate change impacts in Maryland;
- Establishing goals and timeframes; and
- Reporting each year (Nov. 1) on a plan of action including updates, timetables and draft legislation for the coming legislative session.

Our preliminary goals are to reduce greenhouse gas emissions by between 25 and 50 percent between 2006 and 2020 and to obtain 90 percent reductions by 2050. The Commission’s preliminary report and list of strategies in various focus areas will be made public in mid July. Transportation-related policies in the *GHG Strategy* include strategies to slow the growth of VMT, support the development and use of improved technologies and fuels, and other emissions reduction strategies.

Fortunately, Maryland is in a unique position to work across all modes of transportation to implement GHG reduction strategies. As a multi-modal agency with a flexible transportation trust fund and responsibilities for highway, transit, port and airport capital development and operation, MDOT has the opportunity to act effectively. The department has already undertaken various strategies to reduce the growth in VMT including, developing park and ride lots, investing in transit expansions, encouraging telecommuting, providing ridesharing and guaranteed ride home support, and progressing bike and pedestrian projects. Additional mitigation strategies include: requiring idling reduction in MDOT contracts, utilizing hybrid buses and cleaner MARC engines, providing truck stop electrification, tree planting, use of biodiesel by MDOT trucks, and purchasing hybrid cars for our fleet.

Climate change is bringing transit into the forefront of national policy discussions. In Maryland, transit communities are a priority, however, we need a new financial paradigm for supporting transit. Maryland is actively pursuing the establishment of public/private partnerships related to transit oriented development while creating an equity position for the public sector.

To date, most public private activity has been related to highways. Maryland is working to encourage private investments in transit. We are anxious to find ways to establish public private partnerships that allow the private sector to benefit from the state’s investment in transportation while sharing some of the benefit with the state. We would like to create public private partnerships that allow the state to take an equity position in land, projects and businesses that benefit directly from the transportation asset, or in the transportation asset itself, if it is privatized. Under this structure, ongoing equity returns could be directed toward transit operating costs.

Conclusion

Reducing greenhouse gas emissions worldwide will require a major contribution from every country and every economic sector, including transportation. At the same time, our Nation needs a strong transportation system to maintain its competitiveness in the global economy and to expand economic opportunity in all regions and among all parts of the population. We need a strong transportation system to maintain and improve the quality of life by providing a high level of mobility while minimizing impacts to communities and the environment. We need to achieve our transportation goals in a way that is environmentally sustainable. This includes efficiently reducing the emissions of greenhouse gases from the transportation sector as well taking other actions to minimize our carbon footprint.

The effort to reduce greenhouse gas emissions will involve many separate initiatives. Transportation sector initiatives include, improvements in fuel economy; greater usage of low-carbon fuels; better management of our transportation system

to reduce congestion and smooth traffic flows; *and* taking steps that reduce the growth in vehicle miles traveled (VMT).

Technological innovation is the key to progress in greenhouse gas emissions reduction. With increases in fuel economy and a shift to cleaner fuels, it is possible to reduce greenhouse gases while there is some growth in VMT. In the short term, the market will produce additional fuel economy and increased use of alternative fuels. New technologies including hydrogen fuel cells and plug-in electric hybrids are expected to enter commercial production in the next decade. In the period between 2020 and 2050, these and other zero-emission vehicles which no longer burn petroleum are expected to dominate the automotive market. These technologies alone may make it possible to reach the carbon emission goals set by many Governors and mayors for 2050.

The growth in vehicle miles traveled (VMT) is a reflection of overall growth in our economy and our population. However, VMT growth is already flattening due to increasing fuel prices and long-term demographic changes. Regardless of current VMT trends and anticipated technological innovations in automotive fuel economy and fuels, additional measures should be taken to manage demand. Such measures include: increasing transit ridership, finding alternatives to single occupant auto travel and removing the barriers to high density land use development.

Greenhouse gas policies should be based on sound, comprehensive data, including data regarding the cost and feasibility of accomplishing emissions reductions. It is ineffective to set an arbitrary target without knowing how that target could be achieved. We should focus on finding solutions that yield the greatest emission reductions at the least cost.

Also, greenhouse gas policies need to take a broad and balanced approach as climate change solutions will vary from state to state and region to region. As such, individual states/regions should have the flexibility to implement the strategies that will work in their particular circumstances. It is imperative that transportation leaders be involved in the climate change discussion at all levels of government to assist in developing emissions reductions strategies and goals.

Finally, strategies for reducing greenhouse gas emissions from the transportation sector cannot be effectively evaluated or carried out on a project level. A broad, systems-level approach is needed.

Mr. Chairman, Members of the Committee, the importance of the subject you have under discussion today is of vital national importance. It is in the interest of us all to take on the challenge as vigorously and effectively as we can. On behalf of the AASHTO member states, I promise that we will continue to work with you in that effort.

Senator LAUTENBERG. Thank you very much, Mr. Porcari. And I note that you are required to leave promptly, and Senator Stevens hasn't asked to throw any questions at you, so I would just have one.

And I'd like to know what kind of impacts of climate change are considered before DOT undertakes a new project to build a new road. Should they be required to identify climate change impact?

Mr. PORCARI. It's a very good question, Senator. We're—with Maryland as an example, we are currently, actually, mapping all of the projected climate change impacts on all of our transportation infrastructure—roads, rails, bridges, and tunnels, aviation, et cetera. Going forward, in both the location in the design of facilities, we will be taking this into account. I would point out that we have a number of facilities that are severely impacted, like the Port of Baltimore, a number of our bridges and tunnels, and highway network. You have similar examples, throughout the country, where you first have to map what the impacts will be, and then mitigate that in new construction, and reconstruction of older projects.

Senator LAUTENBERG. Just one more thing. How complicating a factor is it to make judgments on the effect on climate? Does it require months of study or is it relatively simple computer formulation?

Mr. PORCARI. Senator, we're really plowing new ground here. To—some of the transportation decisions that we're making, such as doubling transit ridership, tripling our MARC commuter rail capacity, are relatively straightforward. We know those will have a positive impact. We are now turning to the process of getting down to the project-specific level and trying to quantify those impacts, positive or negative. It is one of the things that AASHTO is doing nationally that we can do through this technical assistance program, is provide the framework for all the states to make those kind of evaluations in the future.

Senator LAUTENBERG. Thank you very much, Mr. Porcari.

Mr. PORCARI. Thank you.

Senator LAUTENBERG. And thank the other panelists for their patience in letting us go ahead.

Dr. Dickey, let me hear from you, please.

**STATEMENT OF G. EDWARD DICKEY, PH.D., AFFILIATE
PROFESSOR OF ECONOMICS, LOYOLA COLLEGE IN
MARYLAND; MEMBER, COMMITTEE ON CLIMATE CHANGE AND
U.S. TRANSPORTATION, TRANSPORTATION RESEARCH
BOARD, DIVISION ON EARTH AND LIFE STUDIES, NATIONAL
RESEARCH COUNCIL, THE NATIONAL ACADEMIES**

Dr. DICKEY. Good morning, Mr. Chairman, members of the Committee.

My name is Edward Dickey. I'm Affiliate Professor of Economics at Loyola College in Maryland, and I served as a Member of the National Research Council's Committee on Climate Change and U.S. Transportation.

The charge given to our Committee was to examine the potential consequences of climate change on U.S. transportation. Our definition of "transportation" covers all the modes. Most of us usually focus on transportation's impact on climate change, where the emphasis is on strategies to mitigate these effects. This study was concerned with the converse, examining the potential impacts of climate change on transportation infrastructure and operations and identifying appropriate adaptation strategies.

The main findings of our work are presented in Special Report 290, "The Potential Impacts of Climate Change on U.S. Transportation." The report begins with an acknowledgment that global warming is a real, observable, phenomena, and that resulting climate changes will be marked by weather and climate extremes and surprises, not gradual shifts.

A second finding is that the use of historical weather and climate data may no longer provide an accurate forecasting guide for infrastructure planning and design.

Third, climate change will likely impact all regions of the country and all modes of transportation. Flooding of coastal transportation infrastructure probably poses the greatest risk, because of rising sea levels, coupled with storm surges and land subsidence.

Fourth, climate change will require significant changes in the planning, design, construction, and operation and maintenance of transportation systems.

Last, transportation professionals should acknowledge the challenges posed by climate change, and incorporate current scientific

knowledge into the transportation planning process. Investment choices made today will influence how well the transportation infrastructure adapts far into the future.

Our recommendations can be divided into two broad categories. We begin with the process of making decisions.

First, government agencies and private owners should inventory critical infrastructure to determine which systems are vulnerable to the impacts of climate change.

Second, transportation providers should incorporate climate change into their capital improvement programs, facility designs, maintenance practices, operations, and emergency response plans.

Third, planners and engineers should use risk-based approaches that identify the tradeoffs between improved performance levels against the cost of achieving them when analyzing investment choices.

Fourth, better communication is needed among transportation professionals, climate change scientists, and other related disciplines.

Fifth, ongoing and planned research on climate science and decisionmaking tools should incorporate the needs of transportation decisionmakers. And decisionmakers, on the other hand, should define the types of climate data that would be most useful to them.

Turning to the issue of adaptation to climate change, we have a number of additional recommendations.

Sixth, recent experiences with Hurricanes Katrina and Rita emphasize the importance of making transportation an integral part of response plans to handle emergencies, and how these plans are executed.

Seventh, greater use of technology would enable infrastructure providers to monitor climate change and its possible deleterious effects on structures and systems.

Eighth, we need new design standards that incorporate climate change. The Committee recommends that the U.S. Department of Transportation take the lead, along with professional organizations across all modes, to initiate, immediately, a multiyear, multi-agency research program.

Ninth, in the short term, whenever possible, we need to rehabilitate or construct new transportation infrastructure to higher design standards, especially in vulnerable regions.

Tenth, transportation organizations, such as the American Association of State and Highway Transportation Officials, in cooperation with the Federal Government, should develop mechanisms for sharing best practices.

Eleventh, we would be remiss if we did not mention that land use is an important issue. Much of our population now lives near the coasts, placing themselves, their homes, their businesses, and their transportation systems at greater risk. Land-use planning and zoning decisions are made primarily by local governments, and often involve competing interests that transportation planners cannot resolve. However, greater collaboration among these parties could go a long way toward putting these issues on the table, and such collaboration should be required in the reauthorization of transportation programs.

Twelfth, the Federal Emergency Management Agency, which acts as the insurer of last resort for homeowners in designated flood hazard areas, should re-evaluate the risk reduction effectiveness of the National Flood Insurance Program, in view of projected increases in intense precipitation and storm activity. As a minimum, updating flood insurance rate maps to account for sea level rise and to incorporate land subsidence should be priority in coastal areas.

Senator LAUTENBERG. Thank you very much.

[The prepared statement of Dr. Dickey follows:]

PREPARED STATEMENT OF G. EDWARD DICKEY, PH.D., AFFILIATE PROFESSOR OF ECONOMICS, LOYOLA COLLEGE IN MARYLAND; MEMBER, COMMITTEE ON CLIMATE CHANGE AND U.S. TRANSPORTATION, TRANSPORTATION RESEARCH BOARD, DIVISION ON EARTH AND LIFE STUDIES, NATIONAL RESEARCH COUNCIL, THE NATIONAL ACADEMIES

Good morning, Mr. Chairman and Members of the Committee. My name is Edward Dickey. I am Affiliate Professor of Economics at Loyola College in Maryland at Baltimore and served as a member of the Committee on Climate Change and U.S. Transportation of the National Research Council. The Research Council is the operating arm of the National Academy of Sciences, National Academy of Engineering, and the Institute of Medicine of the National Academies, chartered by Congress in 1863 to advise the government on matters of science and technology.

Our study was initiated by the Executive Committee of the Transportation Research Board (TRB) and funded by TRB, the National Cooperative Highway Research Program, the U.S. Department of Transportation (USDOT), the Transit Cooperative Research Program, the U.S. Environmental Protection Agency, and the U.S. Army Corps of Engineers. Dr. Henry G. Schwartz, Jr., retired chairman of Sverdrup/Jacobs Civil, Inc., and member of the National Academy of Engineering, chaired the expert panel of 13 members who conducted the study.¹ Our report—*Special Report 290: The Potential Impacts of Climate Change on U.S. Transportation*—provides transportation professionals with an overview of the scientific consensus on the current and future climate changes of particular relevance to U.S. transportation, including the limits of present scientific understanding as to their precise timing, magnitude, and geographic location; identifies potential impacts on U.S. transportation and adaptation options; and offers recommendations for both research and actions that can be taken to prepare for climate change.

The study concludes that transportation professionals should acknowledge the challenges posed by climate change and incorporate current scientific knowledge into the planning, design, construction, operation, and maintenance of transportation systems. Every mode of transportation and every region in the United States will be affected as climate change poses new and often unfamiliar challenges to infrastructure providers. Focusing on the problem now should help avoid costly future investments and disruptions to operations.

Challenges of Climate Change

Climate change will affect transportation primarily through increases in several types of weather and climate extremes. Climate warming over the next 50 to 100 years will be manifested by rising sea levels coupled with storm surges and land subsidence, increases in very hot days and heat waves, increases in Arctic temperatures, more frequent intense precipitation events, and increases in the intensity of strong hurricanes. The impacts will vary by mode of transportation and region of the country, but they will be widespread and costly in both human and economic terms and will require significant changes in the planning, design, construction, operation, and maintenance of transportation systems.

¹Other committee members are Alan C. Clark, Houston-Galveston Area Council, Texas; G. Edward Dickey, Loyola College, Baltimore, Maryland; George C. Eads, CRA International, Washington, D.C.; Robert E. Gallamore, Gallamore Group, Rehoboth Beach, Delaware; Genevieve Giuliano, University of Southern California, Los Angeles; William J. Gutowski, Jr., Iowa State University, Ames; Randell H. Iwasaki, California Department of Transportation, Sacramento; Klaus H. Jacob, Columbia University, Palisades, New York; Thomas R. Karl, National Oceanic and Atmospheric Administration, Asheville, North Carolina; Robert J. Lempert, RAND Corporation, Santa Monica, California; Luisa M. Paiewonsky, Massachusetts Highway Department, Boston; Christopher R. Zeppie, Port Authority of New York and New Jersey, New York City.

The past several decades of historical regional climate patterns commonly used by transportation planners to guide their operations and investments may no longer be a reliable guide for future plans. In particular, future climate will include new classes (in terms of magnitude and frequency) of weather and climate extremes, such as record rainfall and record heat waves, not experienced in modern times as human-induced changes are superimposed on the natural variability of the climate.

Decisions transportation professionals take today, particularly those related to the redesign and retrofitting of existing transportation infrastructure or the location and design of new infrastructure, will affect how well the system adapts to climate change far into the future.

Addressing the Impacts of Climate Change on Transportation

Inventory Critical Infrastructure

Potentially, the greatest impact of climate change on North America's transportation system will be flooding of coastal roads, railways, transit systems, and runways because of a global rise in sea level coupled with storm surge and exacerbated in some locations by land subsidence. The vulnerability of transportation infrastructure to climate change, however, will extend well beyond coastal areas. Therefore, Federal, state, and local governments, in collaboration with owners and operators of infrastructure such as ports and airports, and private railroad and pipeline companies should inventory critical transportation infrastructure to identify whether, when, and where projected climate changes in particular regions might be consequential.

Incorporate Climate Change into Investment Decisions

Public authorities and officials at various governmental levels and executives of private companies are making short- and long-term investment decisions every day and should incorporate climate change into their long-term capital improvement plans, facility designs, maintenance practices, operations, and emergency response plans. (See box below, which lays out a six-step approach for determining appropriate investment priorities).

Decision Framework for Transportation Professionals to Use in Addressing the Impacts of Climate Change on U.S. Transportation Infrastructure

1. Assess how climate changes are likely to affect various regions of the country and modes of transportation.
2. Inventory transportation infrastructure essential to maintaining network performance in light of climate change projections to determine whether, when, and where their impacts could be consequential.
3. Analyze adaptation options to assess the trade-offs between making the infrastructure more robust and the costs involved. Consider monitoring as an option.
4. Determine investment priorities, taking into consideration criticality of the infrastructure components as well as opportunities for multiple benefits (e.g., congestion relief, removal of evacuation route bottlenecks).
5. Develop and implement a program of adaptation strategies for the near and long terms.
6. Periodically assess the effectiveness of adaptation strategies and repeat Steps 1 through 5.

Adopt Strategic, Risk-Based Approaches to Decision Making

The significant costs of redesigning and retrofitting transportation infrastructure to adapt to the potential impacts of climate change suggest the need for more strategic, risk-based approaches to investment decisions. Transportation planners and engineers should incorporate more probabilistic investment analyses and design approaches that apply techniques for trading off the costs of making the infrastructure

more robust against the economic costs of failure and should communicate these trade-offs to policymakers who make investment decisions and authorize funding. One model is the California Seismic Retrofit Program, which uses a risk-based approach to analyze vulnerability to earthquakes and criticality of highway bridges to determine priorities for retrofitting and replacement.

Improve Communication

Transportation decisionmakers note that one of the most difficult aspects of addressing climate change is obtaining the relevant information in the form they need to plan and design. Transportation professionals often lack sufficiently detailed information about expected climate changes and their timing to take appropriate action. The National Oceanic and Atmospheric Administration, USDOT, the U.S. Geological Survey, and other relevant agencies should work together to institute a process for better communication among transportation professionals, climate scientists, and those in other relevant scientific disciplines, and establish a clearinghouse for transportation-relevant climate change information. In addition, better decision support tools are needed to assist transportation decisionmakers. Ongoing and planned research at Federal and state agencies and universities that provides climate data and decision support tools should include the needs of transportation decisionmakers.

Integrate Evacuation Planning and Emergency Response into Transportation Operations

Projected increases in weather and climate extremes underscore the importance of emergency response plans in vulnerable locations and require that transportation providers work more closely with weather forecasters and emergency planners and assume a greater role in evacuation planning and emergency response. Climate extremes, such as more intense storms and more intense precipitation, will require near-term operational responses from transportation providers and greater attention to emergency response in transportation operations and budgets. Transportation agencies and service providers should build on the experience in locations where transportation is well integrated into emergency response and evacuation plans.

Develop and Implement Monitoring Technologies

Monitoring transportation infrastructure conditions, particularly the impacts of weather and climate extremes, offers an alternative to preventive retrofitting or reconstruction of some facilities in advance of climate change. Greater use of sensors and other “smart” technologies would enable infrastructure providers to receive advance warning of potential failure due to water levels and currents, wave action, winds, and temperatures exceeding what the infrastructure was designed to withstand. Federal and academic research programs should encourage the development and implementation of these technologies.

Share Best Practices

As the climate changes, many U.S. locations will experience new climate-induced weather patterns. The geographic extent of the United States—from Alaska to Florida and from Maine to Hawaii—and its diversity of weather and climate conditions can provide a laboratory for best practices and information sharing as the climate changes. Drawing on existing technology transfer mechanisms, relevant transportation professional and research organizations should develop a mechanism to encourage sharing of best practices to address the potential impacts of climate change.

Reevaluate Design Standards

Environmental factors are integral to transportation infrastructure design. However, engineers have not given much thought to whether current design standards are sufficient to accommodate climate change. Climate change projections indicate that today’s 100-year precipitation event is likely to occur every 50 years or perhaps even every 20 years by the end of this century. Reevaluating, developing, and regularly updating design standards for transportation infrastructure to address the impacts of climate change will require a broad-based research and testing program and a substantial implementation effort. USDOT should take a leadership role along with professional organizations in the forefront of civil engineering practice across all modes to initiate immediately a federally funded, multiagency research program. The program should focus on the reevaluation of existing design standards and the development of new standards as progress is made in understanding future climate conditions and the options available for addressing them. A research plan and cost proposal should be developed for submission to Congress for authorization and funding. Until new standards are developed, infrastructure rehabilitation projects in highly vulnerable locations should be rebuilt to higher standards.

The development of appropriate design standards to accommodate climate change is only one of several possible adaptation strategies that may require Federal leadership, research, and funding. Federal agencies have not focused generally on adaptation in addressing climate change. Better collaboration could help focus attention on these issues and shape existing research programs. USDOT should take the lead in developing an interagency working group focused on adaptation.

Include Climate Change in Transportation and Land Use Planning

One of the most effective strategies for reducing the risks of climate change is to avoid placing people and infrastructure in vulnerable locations. Transportation planners are not currently required to consider climate change and its effects on infrastructure investments. Land use decisions are made primarily by local governments, which have too limited a perspective to account for the broadly shared risks of climate change. Integration between transportation and land use planning is uncommon. Federal planning regulations should require that climate change be included as a factor in the development of public-sector, long-range transportation plans; eliminate any perception that such plans be limited to 20 to 30 years; and require collaboration in plan development with agencies responsible for land use, environmental protection, and natural resource management to foster more integrated transportation-land use decisionmaking.

Evaluate the National Flood Insurance Program and Flood Insurance Rate Maps

The Federal Government is the insurer of last resort for homeowners in specially designated flood hazard areas. The National Flood Insurance Program, administered by the Federal Emergency Management Agency (FEMA), and the flood insurance rate maps (FIRMs) that determine program eligibility do not take climate change into account. FEMA should reevaluate the risk reduction effectiveness of the National Flood Insurance Program and the FIRMs, particularly because climate change may trigger more intense storms and sea-level rise will extend the scope of flood damage in some special flood hazard areas. At a minimum, updated FIRMs that account for sea level rise (incorporating land subsidence) should be a priority in coastal areas.

Develop New Organizational Arrangements

The impacts of climate change do not follow modal, corporate, or jurisdictional boundaries, yet decisionmaking in the transportation sector is based on these boundaries. Current institutional arrangements for transportation planning and operations were not organized to address climate change and may not be adequate for the purpose. Some models of cross-jurisdictional cooperation exist. Among them are regional authorities for specific facilities (e.g., the Alameda Corridor); regional and multistate emergency response agreements; and state-mandated regional authorities, such as those responsible for air quality improvement. Similar arrangements could emerge to address the effects of sea-level rise on coastal real estate and infrastructure, drought on shipping along inland waterways, and hurricanes in the Gulf Coast region. However, state or Federal incentives may be required to ensure the development of such organizational arrangements at the regional or multistate level.

Actions to prepare for climate change can be taken almost immediately. Some steps can be undertaken by local governments and private infrastructure providers. Others depend on Federal and state action. In all cases, leadership and continuing commitment are essential.

Thank you for inviting me to testify today. I would be happy to address any questions the Committee might have.

Senator LAUTENBERG. Mr. Friedman?

STATEMENT OF DAVID FRIEDMAN, RESEARCH DIRECTOR AND SENIOR ENGINEER, THE UNION OF CONCERNED SCIENTISTS

Mr. FRIEDMAN. Thank you, Mr. Chairman.

I'm the Research Director and a Senior Engineer for the Union of Concerned Scientists. Thank you for holding this hearing, because the topic is extremely urgent.

Put simply, global warming is the largest long-term environmental threat facing the country and the world. If we are to avoid the worst impacts of climate change, our country must cut global

warming pollution by at least 80 percent in 2050, when compared to emission levels in the year 2000. Of course, we can't just sit around and wait, for decades, to begin. U.S. global warming pollution must be cut by more than 20 percent below 2000 levels by 2020.

For transportation to play a role, we need to rethink the system. In doing so, we will not only dramatically lower global warming pollution, we will cut our addiction to oil, we will save consumers billions, and we will create new high-quality jobs throughout America.

One of the important tools that must be put in place is an economy-wide cap-and-trade policy. But, while a cap is essential to curbing global warming pollution, it will not push the transportation sector to do its share over the next 20 to 30 years.

Recent analysis from the Energy Information Administration shows that others must pick up the slack. As a result, it will be more expensive to control global warming pollution.

A cap-and-trade market fails transportation consumers, because there are too few alternatives to going about our daily travel. Consumers and corporations need better vehicles, viable alternatives to cars and freight trucks, and sustainable fuels with a low global warming pollution footprint. And they need these solutions as soon as possible, much faster than the market can provide.

This Committee is already quite familiar with policies to require better vehicles. The Ten-in-Ten Fuel Economy Act, by requiring at least a 10-mile-per-gallon increase in fuel economy for cars and trucks, will cut new vehicle global warming pollution by nearly 30 percent. It will also save consumers money at the pump. At today's \$4.00 per gallon, the 35-mile-per-gallon minimum is the equivalent of cutting gas prices by more than one dollar. The Committee also opened the door to fuel economy standards for medium- and heavy-duty trucks. But, the Committee's work is far from over. Rail, air, and shipping can also benefit from improved efficiency.

There is also more work to be done in the fuel economy of cars and trucks of all shapes and sizes. Despite the fact that their own analysis indicates that we could reach the 35-mile-per-gallon minimum fuel economy standard by 2015—that is 5 years early—the Department of Transportation is relying on a flawed rulemaking that, at best, just barely puts cars and trucks on the road to 35 by 2020.

In their work, NHTSA relied on gas price projections of \$2.25 to \$2.50 per gallon. Gas is over \$4.00 a gallon today. Even the head of the Energy Information Administration recently publicly said that the Department of Transportation should use their high oil and gas price scenario, not the scenario they used.

Further, NHTSA effectively ignored the cost of global warming and assumed hybrids would not be available until 2014, despite the fact that the Toyota Prius, a hybrid, is the ninth-best-selling car in the country today. Instead of doing the bare minimum to satisfy the law, NHTSA should put cars and trucks on a path to 40 miles per gallon by 2020, and at least 50 by 2030. This will cut global warming pollution from new cars and trucks in half by 2030, and would save about 50 billion barrels of oil through 2050.

Of course, efficiency isn't enough. Both urban and suburban areas need greater access to public transportation. As of 2001, less than one-third of the U.S. population lived within about a block of a bus line, and only about one-quarter lived within 5 miles of a rail stop. Consumers also need improved access to high-occupancy-vehicle lanes, bike lanes, and more affordable housing near where they work. Corporations need many of the same solutions.

For these options to work, we will need money to fund them and the willingness to use them. Whether it is pay-as-you-drive insurance, road-user fees, per-mile congestion fees, charging per mile rather than per year or per gallon can create a revenue stream to allow us to repair our roads and bridges, plus to provide funding for transit and other alternatives. We are already paying these costs, but consumers don't see it in their daily lives. Making them visible will provide a direct incentive to use the newly available alternatives.

In addition, we also need to clean up our fuels. By 2050, we need the equivalent of 150 to 200 billion gallons of gasoline with as much as an 80-percent reduction in global warming pollution compared to today's gasoline.

To supply this fuel, we must tap into sustainable biofuels, renewable electricity, and clean hydrogen. But, these resources will not appear overnight, nor will the vehicles that must be sold to use these low-carbon fuels. We need to institute a low-carbon fuel standard. And, because plug-ins, fuel-cell vehicles, and battery-electric vehicles are currently significantly more expensive than even hybrids, we will need a combination of performance-based vehicle incentives and an ultra-low-carbon vehicle requirement. Policies like these will help us rethink our transportation system.

Mr. Chairman, I am an engineer, and, as such, I was trained to be a problem-solver. And climate change is the largest long-term environmental threat there is. We have the necessary solutions to deal with this problem. What we have lacked is the will.

Thank you.

[The prepared statement of Mr. Friedman follows:]

PREPARED STATEMENT OF DAVID FRIEDMAN, RESEARCH DIRECTOR AND SENIOR
ENGINEER, THE UNION OF CONCERNED SCIENTISTS

Mr. Chairman and Members of the Committee, I appreciate the opportunity to testify before you today. I am a research director and senior engineer with the Union of Concerned Scientists (UCS). UCS is a leading science-based nonprofit that has been working for a healthy environment and a safer world for over 30 years.

The topic of this hearing, transportation and climate change, could not be more urgent. Put simply, global warming is the single biggest long term environmental threat facing the country and the world. But within this threat are buried opportunities. Every step we take to curb transportation's role in global warming will also cut America's oil addiction—and most, if not all, of these will also save consumers money. At the same time, the investments we make to become the world's leader in climate change solutions will strengthen our economy as we export the technology that will be essential to avoid the worst impacts of global warming.

Transportation, Targets, and Climate Caps

If we are to avoid the worst impacts of climate change, *our nation and the world must adopt a target that will keep global temperature from rising more than 2 °C above pre-industrial levels.* That means stabilizing the concentration of global warming pollutants in our atmosphere at no more than 450 parts per million carbon dioxide equivalent. Analysis by UCS shows that *one part of achieving this goal means the United States must cut global warming pollution by at least 80 percent* compared

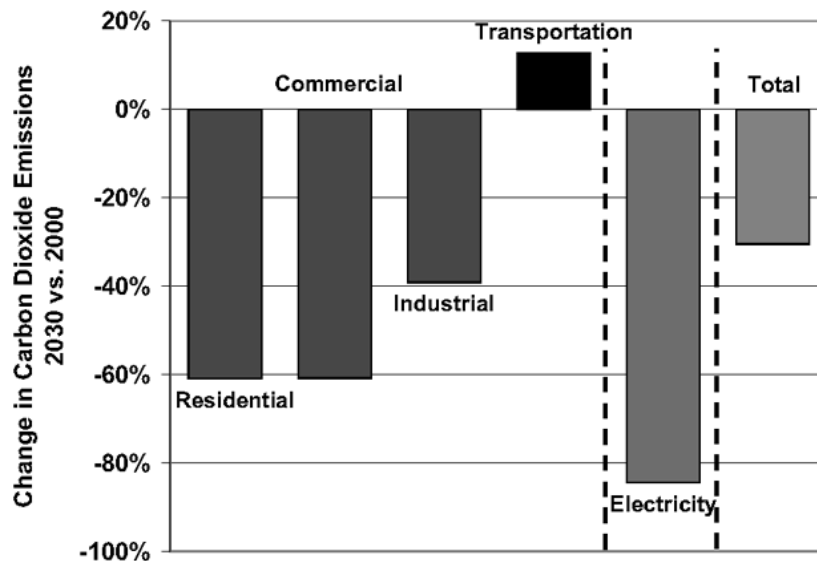
to emission levels in 2000.¹ In addition, UCS analysis indicates that *U.S. global warming pollution must be cut by more than 20 percent below 2000 levels by 2020, and at least 50 percent below by 2030.*

There is no single silver bullet that will dramatically cut U.S. global warming pollution and no single sector will be able to carry the full burden. Instead, *the country will have to put in place a comprehensive climate and energy policy that encourages a diverse portfolio of solutions in every sector.* Transportation, including the cars and trucks consumers drive every day, will have to play a significant role in meeting this essential 80 percent reduction minimum and all options for cutting pollution from transportation must be on the table. The good news is that *every sector, including transportation, has many tools at its disposal.*

The debate has already begun on one of the most important tools that must be put in place to limit the total amount of global warming pollution humans create: a cap-and-trade policy that would ensure that the U.S. is on a path to do its part to limit global temperatures from rising above 2 °C, including at least an 80 percent reduction in U.S. global warming pollution by 2050.

This cap must apply to all sectors, including transportation, but even that will still not be enough to ensure that transportation does its part. While it needed significant strengthening, the recently discussed Climate Security Act (S. 2191) provides a good example of the strengths and weaknesses of cap-and-trade policy. By 2030, EIA estimated that S. 2191 would cut global warming pollution by more than 30 percent compared to emissions in 2000.² However, at the same time that most sectors are projected to contribute reductions of 40 percent to 80 percent, the transportation sector is projected to continue to increase.

Figure 1. Energy Information Administration Analysis of the Climate Security Act (S. 2191).



Supporting Transportation Climate Policy on a Three-Legged Stool

The transportation sector simply does not do its share under a cap-and-trade system. Instead, despite the fact that many transportation solutions can save money while cutting global warming pollution, other sectors must pick up the slack to ensure that the overall cap is still met. This dynamic is a sign of market failures that will lead to higher costs than are necessary for controlling global warming pollution.

Put simply, the market fails transportation consumers because there are too few alternatives to doing things other than the way we have been doing them for the past sixty years:

¹ http://www.ucsusa.org/assets/documents/global_warming/emissions-target-report.pdf.

² <http://www.eia.doe.gov/oiaf/servicerpt/s2191/index.html>.

- *Most of the planes, trains, ships, and automobiles we rely on were designed during the days of cheap oil when fuel efficiency was not a priority.* Manufacturers have been slow to respond to recent consumer demands for fuel economy. In addition, consumers have shown themselves slow to change. Gas prices have more than tripled since 2000 and consumers have only just begun to shift their purchasing and driving habits.
- *Both personal travel and goods movement have evolved around our extensive and dispersed national highway system.* Compact, walk-able or bike-able communities and easy access to transit are the exception rather than the rule. Consumers and corporations lack choices to substitute for reliance on our cars and trucks.
- *The transportation sector is almost exclusively reliant on fossil fuels, a fuel with a very high global warming footprint.* Alternative fuels meet only about 0.2 percent of U.S. transportation fuel needs.

These faults can be fixed by moving beyond the piecemeal approach that has historically characterized U.S. energy and transportation policy and instead applying a comprehensive approach that addresses these three market failures to build a solid foundation to support transportation's role in a national cap-and-trade policy.

Increasing Fuel Economy

To tackle global warming, reduce America's oil addiction, and save consumers tens of billions of dollars, we must give consumers and corporations new options to use fuel more efficiently when they travel or ship goods. This can be achieved either through vehicle global warming pollution standards or by setting fuel economy standards.

Through the Ten in Ten Fuel Economy Act, *this Committee led the Nation forward on fuel economy for cars and light trucks for the first time in more than three decades. And for the first time ever, the door was opened to fuel economy standards for medium and heavy duty trucks thanks to this Committee.*

The projected benefits of just the light-duty portion of the Ten in Ten Fuel Economy Act highlight the importance of keeping efficiency a top priority. Meeting the minimum fuel economy requirement of 35 miles per gallon would cut global warming pollution for new cars and trucks nearly 30 percent by 2020. The minimum will also reduce oil consumption by nearly 9 billion barrels through 2030, rising to about 30 billion barrels saved through 2050. And finally, boosting fuel economy from today's 25 mpg average to 35 mpg will save consumers the equivalent of reducing the price of today's \$4 per gallon gasoline by more than one dollar.

The example of car and truck efficiency must be repeated and reinforced throughout the transportation sector. *Delivery trucks and 18-wheelers could increase fuel economy from today's level of less than 7 mpg for new vehicles to 10–11.5 mpg by 2030.* This represents a boost of 50–70 percent while maintaining or expanding today's hauling capacity. However, because of language in Ten in Ten, it may be at least 8 years before this committee's medium and heavy duty standards are put to work. Given the significant impacts the freight sector will feel from climate change, this committee should work to accelerate the Department of Transportation's reporting and rulemaking responsibilities in this area.

Rail, air, and shipping can also benefit from improved efficiency. For example, *rail efficiency could be improved by about 1 percent per year starting in 2015.*

Finally, there is more work to be done on the fuel economy of cars and trucks. A recent UCS report indicates that automakers can cost-effectively boost the fleetwide average fuel economy of cars and trucks to 40 mpg by 2020 and to more than 50 mpg by 2030.³ Yet the recent notice of proposed rulemaking from the Department of Transportation's National Highway Traffic Safety Administration (NHTSA), at best, just barely puts cars and trucks on the road to the 35 mpg minimum by 2020.⁴

Instead of doing the bare minimum to satisfy the law, *NHTSA should put cars and trucks on a path to 40 mpg by 2020 and at least 50 mpg by 2030. This would cut global warming pollution from new cars and trucks in half by 2030 and would save about 50 billion barrels of oil through 2050.*

NHTSA appears unwilling or unable to move the country on this path and *this Committee should exercise its oversight authority to ask NHTSA to fix a variety of flaws used in setting their proposed standards:*

³http://www.ucsusa.org/assets/redesign-documents/clean_vehicles/UCS-Setting-the-Standard.pdf.

⁴http://www.ucsusa.org/news/press_release/new-fuel-economy-proposal-star-0111.html.

- While gasoline prices soared above \$3 per gallon this winter and have crossed \$4 per gallon this summer, NHTSA relied on projections of \$2.25–\$2.50 per gallon.
- While carbon dioxide is currently trading at more than \$40 per metric ton in Europe, NHTSA used a value of \$7 per ton. NHTSA even considered \$0 per ton to be in the range of possible values, implying that global warming does not exist or will cause no harm.
- NHTSA left out the military and strategic costs of America's oil addiction.
- NHTSA assumed light trucks would grow in market share, but between 2005 and 2008 the market share of light trucks sold from January to May dropped from 54 percent to 48 percent.
- NHTSA assumed hybrids were not available until 2014 despite the fact that the Toyota Prius, a hybrid, is the 9th best selling car in the country today.
- NHTSA based its rulemaking on costs and benefits on the margin rather than the total costs and benefits of improved standards.

Changes along these lines would redirect NHTSA's efforts to the intent, not just the letter, of the law passed as part of Ten in Ten. *NHTSA's own analysis confirms that simply switching to total benefits, even with their poor gas price assumptions, would have led them to propose a fleetwide average of at least 35 mpg by 2015—five years earlier than the required minimum.*⁵ More realistic gas prices, even only setting the standard based on the marginal benefits, would also have led NHTSA to propose a fleetwide average over about 35 mpg by 2015.⁶

Making matters worse, not only will NHTSA's poor analysis shortchange consumers and lead to lower global warming pollution reductions, we can expect a similar approach to shortchange trucking companies and the environment when NHTSA address fuel economy standards for medium and heavy duty vehicles. *This Committee's oversight role is essential to avoiding this outcome.*

Smarter Travel, Freight, Cities

While great strides can be made to improve vehicle efficiency, *it is unlikely that technology alone will be able to keep pace with growing demand for personal and freight travel if we continue on our current path.* As a result, despite the potential for parts of the transportation sector to increase efficiency by 50 percent or 100 percent, global warming pollution from transportation will continue to increase beyond current levels.

For example, if projected trends from the Energy Information Administration's Annual Energy Outlook 2008 continue through 2050, medium and heavy duty vehicles could see demand increase by more than 130 percent. If the fuel economy of all delivery trucks and 18-wheelers on the road were increased by about 70 percent, that would still not be enough to compensate for the increase in demand. As a result, global warming pollution in this sector would still rise by more than 20 percent in 2050 compared to levels in 2000. Compared to a goal of an 80 percent reduction in global warming pollution, a 20 percent increase clearly won't cut it.

Growing travel demand is a core barrier to avoiding the worst impacts of climate change, but historical travel growth has also been a key part of U.S. economic growth. *The challenge is to rethink and redesign our transportation system to allow for continued economic growth without as many miles.*

As with efficiency, the first step is to ensure that consumers and corporations have alternatives other than business as usual. *Both urban and suburban areas need greater access to public transportation*, which produces significantly less global warming pollution per person than cars and trucks. As of 2001, less than one-third of the U.S. population lived within about a block of a bus line, while only about 40 percent lived within a half mile.⁷ The situation is even worse for rail, where only about 10 percent of U.S. population lived within a mile of a rail stop, while only about one quarter lived within five miles.⁸

In addition to transit, *consumers need improved access to high occupancy vehicle (HOV) lanes, bike lanes, and more affordable housing near where they work.* Corporations need many of the same things. While 18-wheelers provide a lot of flexibility in the freight world, it takes 5–7 times more energy to ship a ton of goods

⁵ Page III-6 in NHTSA's Preliminary Regulatory Impact Analysis for their proposed fuel economy standards for Model Year 2011–2015 cars and light trucks.

⁶ *Ibid.*, pages IX–12 and IX–13.

⁷ *Public Transit in America: Analysis of Access Using the 2001 National Household Travel Survey*, Center for Urban Transportation Research, University of South Florida, Tampa, February 2007.

⁸ *Ibid.*

on a truck than on rail—switching more miles from long-haul trucking to rail will put a real dent in global warming pollution from freight. Trucks and buses might also benefit from their own dedicated lanes where they are not caught up in as much stop and go traffic, making highways safer as well.

For these various new options to work, two key resources are needed: the money to fund them and the willingness to use them. Thankfully, in many cases, a system that makes sure people and products carry the full cost of their travel can help with both. *Whether it is insurance, wear and tear on highways and bridges, or the costs of the pollution produced from tailpipes, charging per mile rather than per year or per gallon can create both a revenue stream for the needed investments and a more direct incentive to try out the newly available approaches.*

Some examples of these approaches include:

- *Pay as you drive insurance:* If you drive less, you are less likely to get into an accident. Paying for insurance by the mile rather than just by the car would both provide a more equitable distribution of insurance payments and encourage people to drive less.
- *Per mile road user fees:* Current highway construction and maintenance costs, and some transit costs, are covered by per gallon fuel taxes. Because fuel efficiency must go up to address global warming, projected tax receipts will go down compared to a business as usual scenario. Per mile road user fees, adjusted to vehicle weight, could maintain a steadily growing revenue stream to keep our roads and bridges from falling apart while encouraging consumers and corporations to seek less expensive alternatives.
- *Per mile pollution or congestion fees:* Accidents and wear and tear are not the only costs associated with every mile we drive. Vehicles of all sizes cause smog-forming and toxic pollution that lead to increased health care costs and even fatalities. Traffic also costs time because of the delays created by congestion. Per mile pollution and congestion fees can become steady funding sources to hold people responsible for the damage they create while creating a funding stream for alternatives, plus they would provide another incentive to drive less. Per mile pollution and congestion fees tied to air travel and freight could be great ways to finance high-speed rail or simply much needed reinvestment into the country's conventional rail infrastructure.
- *Location efficient mortgages:* Current tax codes give consumers the same break on their mortgage interest no matter where they live. While these tax breaks have helped many live out the American dream of owning a house, they have also helped lower the cost of owning homes that are farther from where people work, increasing daily travel. Revamping that tax code to provide greater tax breaks for those who live closer to work or transit will still help people realize a part of the American dream while ensuring it does not become a nightmare of pollution and congestion.

This is not intended to be an exhaustive list, but instead points the way to policies and practices that could help cut projected personal travel by 25 percent to 35 percent by 2050 (15 percent–20 percent by 2030) and could contribute to reducing the amount of freight that is trucked by 20 percent or more by 2050. Even more innovative approaches, such as reserving downtown areas for walking, biking, and public transit, or directly integrating our personal and freight vehicles with a mass transit system, could be part of a smart growth revolution that allows us to rethink how we move people and goods.

Fueling Up with Low Carbon Alternatives

The combination of investments in improved vehicle efficiency and alternatives to continuing historic growth in travel can go a long way to cutting global warming pollution from the transportation sector. However, *if our economy continues to grow as it has over the last 20 years, these solutions will not be enough to cut global warming pollution from transportation by at least 80 percent compared to levels in 2000.*

To reach those deep cuts while continuing to strengthen our economy, we must also tap into transportation fuels that do not release significant amounts of carbon dioxide. If we combine all of the approaches above for our light-duty cars and trucks, then by 2050 we will still need to supply the equivalent of 80 to 110 billion gallons of gasoline with 70–80 percent less global warming pollution than today's fuel. For medium and heavy duty trucks, we will need the equivalent of another 30 to 40 billion gallons of gasoline with 75–80 percent less global warming pollution. And for the remainder of the transportation sectors, we will need yet another 40 to 50 billion gallons of low carbon fuel.

That means, by 2050, we will need the equivalent of 150 to 200 billion gallons of gasoline with as much as an 80 percent reduction in global warming pollution compared to today's gasoline. And, while biofuels will play an important part in a low carbon future, it is unlikely, at best, that we can sustainably produce sufficient low-carbon biofuel in the U.S. A more realistic estimate of sustainable biofuel potential, one that minimizes tradeoffs between food and fuel and does not encourage deforestation in other countries, would be closer to 40 to 50 billion gallons, unless breakthroughs are achieved in novel biomass resources.

To supply the rest of transportation's needed energy, we must tap into renewable electricity and clean hydrogen. But these resources will not appear overnight, nor will the vehicles that must be sold to use these low-carbon fuels. We will need multiple policies to bring about the needed fuel revolution:

- *A low carbon fuel standard (LCFS) must be put in place to cut global warming pollution by 10 percent by 2030 and up to 80 percent by 2050.* While the recently passed Renewable Fuel Standard applies global warming pollution standards to biofuels, the required amount would only represent about 10 percent of current demand, leaving 90 percent of transportation fuel unregulated.
- *An ultra-low carbon fuel standard is also needed to accelerate demand for fuels that dramatically cut global warming pollution.* While a 10 percent low carbon fuel standard may be appropriate for 2030, it will mainly put a stop to dirty fuels such as liquid-coal and encourage fuels with only modest improvements. *To created demand for the cleanest biofuels, electricity and hydrogen, there should be a carve-out in the LCFS for a minimum volume of the cleanest fuels.*
- *Vehicle incentives and an ultra-low carbon vehicle requirement will also be essential to ensure that the vehicles are there to use the fuel.* Fuel cell vehicles, battery electric vehicles, and plug-ins are currently significantly more expensive than conventional vehicles or even hybrids. Economic incentives and requirements will be needed to overcome the valley of death experienced by new technologies.

Conclusion

If left unchecked, climate change will have direct and significant impacts on our transportation system. But that same system can be an essential part of the solution set to help avoid the worst impacts of climate change.

The U.S. needs to move away from a piecemeal approach to transportation energy and environmental policy and instead adopt a comprehensive set of policies that will tap into both the near term and long term solutions that are available or on the drawing boards. This will require a longer term perspective and a combination of consistent, significant, and sustained policies. Yes, we do need to rethink our transportation system, but in doing so, we will not only dramatically lower global warming pollution, we will save consumers billions, create new jobs in America and ultimately cut our addiction to oil.

Senator LAUTENBERG. Thank you very much.
And now, Mr. Hamberger, welcome.

STATEMENT OF EDWARD R. HAMBERGER, PRESIDENT AND CHIEF EXECUTIVE OFFICER, ASSOCIATION OF AMERICAN RAILROADS

Mr. HAMBERGER. Thank you, Mr. Chairman and Mr. Vice Chairman, Senator Stevens.

The Association of American Railroads appreciates this opportunity to address the issue of climate change and transportation. At the outset, I would suggest that one area where everyone can and should agree is that greater use of rail transportation, both for freight and for passengers, offers a simple, cost-effective, and immediate way to meaningfully reduce greenhouse gas emissions without harming the economy.

One way railroads positively impact the environment is by reducing fuel and energy consumption. Railroads, last year, were able to move a ton of freight an average of 436 miles on one gallon of fuel.

It's like moving a ton of freight from Boston to Baltimore on one gallon of fuel.

Railroads have an impressive record of improving their fuel efficiency. Since 1980, our fuel efficiency has improved by 85 percent. Last year alone, freight railroads used 3.5 billion fewer gallons of fuel than we would have without that improvement. And important for this hearing is that that improved fuel efficiency translates into substantial reductions in emissions of greenhouse gases. In fact, that 3.5-billion-gallon savings in fuel I've just referenced means that railroads last year emitted 39 million fewer tons of carbon dioxide than they would have, otherwise. And since railroads are three or more times as fuel efficient as trucks, every ton-mile of freight that moves by rail instead of highways reduced greenhouse gas emissions by two-thirds or more. Shifting just 10 percent of the long-haul freight that moves by truck would produce an annual fuel savings of more than 1 billion gallons of fuel, resulting in a reduction of annual greenhouse gas emissions of more than 12 million tons.

The railroad fuel efficiency advantage helps explain why freight railroads account for just 2.6 percent of transportation-related greenhouse gas emissions, and just .7 percent of total U.S. greenhouse gas emissions.

Freight train emissions are also less for other types of pollutants. The EPA estimates that for every ton-mile, a typical truck emits three times more NO_x and particulates than a locomotive. And just 3 months ago, the EPA issued stringent new locomotive emission standard guidelines that will cut particulate matter by up to 90 percent and nitrogen oxide by up to 80 percent.

Freight rail can also help reduce gridlock on America's highways, saving commuters time, money, and fuel. A single freight train can take hundreds of trucks off the highways. If 25 percent of freight volume was shifted from trucks to rail by 2026, commuters could save an average of 41 hours a year in commuting time, 79 gallons of fuel, and \$1,000 in total congestion costs.

Now, just as expanded freight rail would be good for the environment, so would expanded passenger rail. The average intercity passenger train produces 60 percent lower carbon dioxide emissions per passenger mile than the average automobile, and half as much as an airplane. The public benefits of a truly attractive and competitive national passenger rail capability will, indeed, exceed public costs.

The AAR was pleased to support passage of the Amtrak reauthorization bills in both the House and the Senate, and I hope a Conference Report can be passed yet this summer.

At your hearing, 2 weeks ago, Mr. Chairman, you heard that the demand for freight in the U.S. will almost double over the next 25 years. And, given the green advantage of rail, policymakers would do well to encourage more of that freight to move over the Nation's rail network.

I would like to offer three policy initiatives that would aid railroads in expanding capacity to meet that demand.

First, enactment of the Freight Rail Infrastructure Capacity Expansion Act, S. 1125, which provides a tax credit for investments

in new rail capacity. That credit would be available not just to railroads, but to any entity that invests in rail capacity expansion.

Second, passage of the Short Line Rail Investment Act, which extends a targeted tax credit for smaller railroads that expired at the end of last year.

Third, encouragement of public/private partnerships in which the public pays for the benefits it receives, and the railroads pay for the benefits they receive. The Chicago Create Project, the Heartland Corridor, and the Alameda Corridor are all examples of such projects in which public and private dollars are leveraged together to produce public benefits both for capacity for passenger rail, as well as freight rail, that otherwise would not be realized.

We look forward to working with the Members of this Committee in developing programs that will help our Nation address climate change issues and continue to move passengers and freight by rail.

Thank you.

[The prepared statement of Mr. Hamberger follows:]

PREPARED STATEMENT OF EDWARD R. HAMBERGER, PRESIDENT AND CHIEF
EXECUTIVE OFFICER, ASSOCIATION OF AMERICAN RAILROADS

The Association of American Railroads (AAR) appreciates the opportunity to address the issue of climate change and transportation. AAR members account for the vast majority of freight railroad mileage, employees, and traffic in Canada, Mexico, and the United States.

Few topics today generate as much debate as climate change. I respectfully suggest, however, that one area where everyone can and should agree is that greater use of rail transportation offers a simple, cost-effective, and immediate way to meaningfully reduce greenhouse gas emissions without potentially harming the economy.

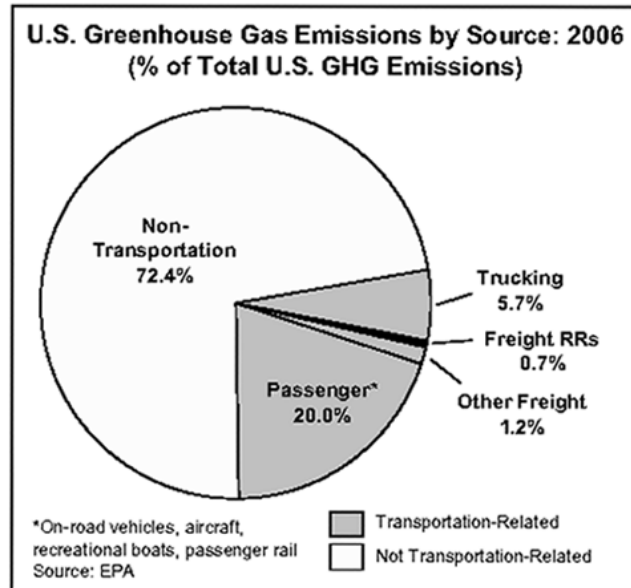
Given this fact, I also respectfully suggest that policymakers should take steps to attract more freight and passengers to railroads and expand the substantial greenhouse gas and other public benefits of rail transportation—for example, by implementing an investment tax credit for rail infrastructure capacity expansion projects; by encouraging greater use of rail-related public-private partnerships; and by adequately funding Amtrak to allow it to bring the Northeast Corridor to a state of good repair, procure new rolling stock, and make additional capital improvements and maintenance over its network.

Freight and passenger railroads have a strong record of success in meeting our Nation's transportation needs in an environmentally-friendly fashion. They are committed to pursuing further technological and operational advancements that will lead to continued tangible improvements in fuel efficiency, mobility, greenhouse gas emissions, and air quality.

Railroads Are the Most Fuel-Efficient Form of Surface Freight Transport

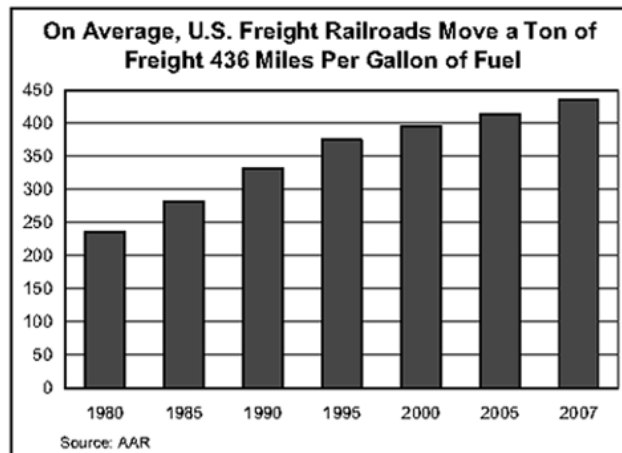
According to EPA data, in 2006 total U.S. greenhouse gas emissions were 7,054 teragrams¹ of carbon dioxide equivalents, with transportation accounting for 28 percent of the total. The vast majority of transportation-related greenhouse gas emissions are directly correlated with fossil fuel consumption: the higher the fuel consumption, the greater the greenhouse gas emissions.

¹ A teragram is a million metric tons or 1.1 million short tons.



Freight railroads, though, are the most fuel efficient mode of surface transportation. In 2007, railroads moved one ton of freight an average of *436 miles* per gallon of fuel—roughly the distance from one end of Nebraska to the other, or from Boston to Baltimore.

Indeed, on a ton-miles² per gallon of fuel basis, freight railroads are *three or more times more fuel efficient than trucks*. That means that *every ton-mile of freight that moves by rail instead of truck reduces greenhouse gas emissions by two thirds or more*.



The railroad fuel efficiency advantage helps explain why freight railroads account for just 2.6 percent of transportation-related greenhouse gas emissions and just 0.7 percent of total U.S. greenhouse gas emissions, according to the EPA.

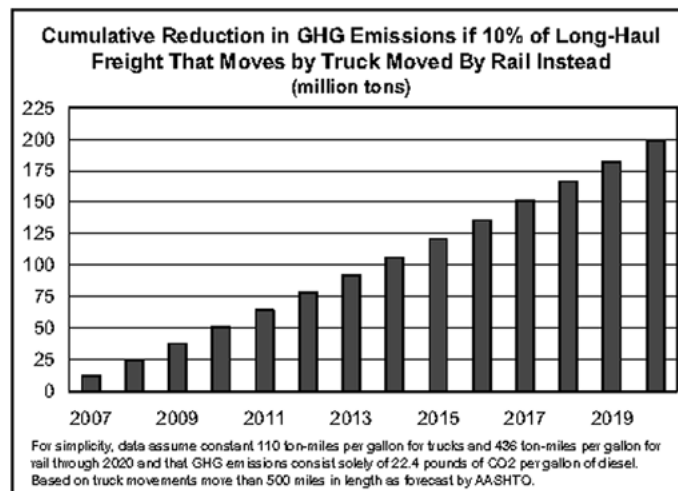
²A ton-mile is the movement of one ton of freight one-mile. It is a standard way to measure freight volume across transportation modes.

U.S. Greenhouse Gas Emissions By Economic Sector: 2006			U.S. Greenhouse Gas Emissions from Transportation: 2006		
Economic Sector	Tg CO ₂ Eq.	% of Total	Economic Sector	Tg CO ₂ Eq.	% of Total
Electr. generation	2,377.8	33.7%	Trucking	404.6	20.8%
Residential	344.8	4.9%	Freight Railroads	51.5	2.6%
Industry	1,371.5	19.4%	Waterborne Freight	30.2	1.5%
Agriculture	533.6	7.6%	Pipelines	32.4	1.7%
Transportation	1,969.5	27.9%	Aircraft	157.4	8.1%
Commercial	394.6	5.6%	Recreational Boats	17.4	0.9%
U.S. Territories	62.4	0.9%	Passenger Railroads	6.4	0.3%
Total	7,054.2	100.0%	Pass. Cars & Light Duty Trucks	1,236.9	63.5%
Data are in teragrams of CO ₂ equivalents.			Buses	12.5	0.6%
Source: EPA, <i>Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006</i> , Tables ES-7, A-100, and A-101.			Total	1,949.3	100.0%
Totals for "transportation" in the two tables do not match exactly because of estimation issues.					

Moving More Freight By Rail is in the Public Interest

Trucks are, and will continue to be, critical to freight transportation and to our economy. But based on data from a study by the American Association of State Highway and Transportation Officials (AASHTO), for each 1 percent of long-haul freight moved by rail instead of by truck, fuel savings would be around 110 million gallons per year and annual greenhouse gas emissions would fall by around 1.2 million tons. If 10 percent of long-haul freight now moving by truck moved by rail instead, annual fuel savings would exceed one billion gallons and annual greenhouse gas emissions would fall by more than 12 million tons.

Moreover, because freight transportation demand is expected to rise sharply in the years ahead, future fuel savings—and greenhouse gas reductions—would be much higher if more freight moved by rail. AASHTO projects that ton-miles for truck movements more than 500 miles long will increase from 1.40 trillion in 2000 to 2.13 trillion in 2020. If 10 percent of these long-haul truck movements went by rail (perhaps via efficient intermodal movements involving both railroads and trucks), cumulative greenhouse gas reductions from 2007 to 2020 would be around 200 million tons.



The public benefits of freight rail do not stop there, however. Moving more freight by rail would also help reduce highway congestion, which costs \$78 billion just in wasted travel time (4.2 billion hours) and wasted fuel (2.9 billion gallons) each year, according to the Texas Transportation Institute's *2007 Urban Mobility Report*. (The total costs of congestion are far higher if lost productivity, costs associated with cargo delays, and other items are included.) A typical train, though, takes the

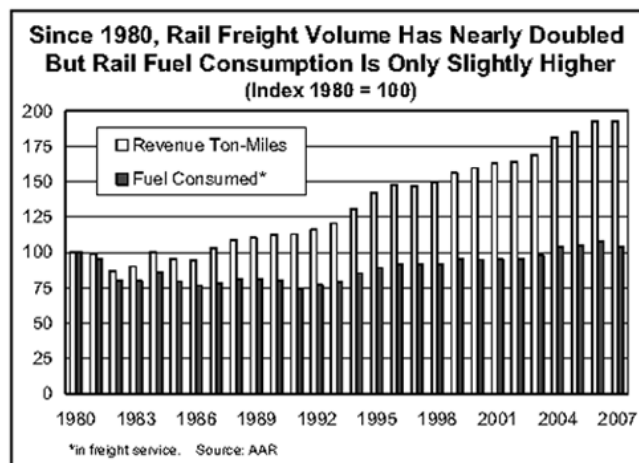
freight equivalent of several hundred trucks off our congested highways, thus enhancing mobility and reducing the amount of greenhouse gases emitted by motor vehicles stuck or slowed in traffic. Railroads also reduce the costs of maintaining existing roads and reduce the pressure to build costly new roads, freeing up limited funds for other purposes.

Finally, railroads also release far less of other types of emissions than other modes of transport. The EPA estimates that for every ton-mile, a typical truck emits roughly three times more nitrogen oxides and particulates than a locomotive. Other studies suggest an even greater advantage for railroads. In March 2008, the EPA issued stringent new locomotive emissions guidelines that, when fully implemented, will cut particulate matter emissions by locomotives by as much as 90 percent and nitrogen oxide (NO_x) emissions by as much as 80 percent compared to locomotives meeting the most stringent standards set in 1998. The new standards will also yield sizable reductions in emissions of hydrocarbons, carbon monoxide, and other air toxics.

Railroads: The Best Choice for the Environment (Emissions Per Ton-Mile)					
Rank (1= Most Desirable)	Oxides of Nitrogen	Volatile Organic Compounds	Particulate Matter	Carbon Monoxide	Carbon Dioxide
1	Rail	Rail	Air	Rail	Rail
2	Water	Water	Rail	Water	Water
3	Truck	Air	Water	Air	Truck
4	Air	Truck	Truck	Truck	Air
Source: Envirotrans					

Railroads Are Constantly Working to Improve Fuel Efficiency and Reduce Greenhouse Gas Emissions Even More

In 1980, one gallon of diesel fuel moved one ton of freight by rail an average of 235 miles. As noted earlier, by 2007 railroads moved one ton of freight an average of 436 miles per gallon of fuel. Thanks to this improvement in fuel efficiency, in 2007 alone Class I freight railroads used *3.5 billion fewer gallons of fuel*—and emitted nearly *39 million fewer tons of carbon dioxide*—than they would have if their fuel efficiency had remained constant since 1980. From 1980 through 2007, U.S. freight railroads consumed 48 billion fewer gallons of fuel and emitted 538 million fewer tons of carbon dioxide than they would have if their fuel efficiency had not improved.³



³Today, U.S. freight railroads today consume approximately 4.4 billion gallons of diesel fuel per year.

Railroads are investing heavily in “cleaner and greener” technologies and other efforts to further improve their fuel efficiency. Just a few examples include:

- *New locomotives.* Railroads have spent billions of dollars in recent years on thousands of new, more environmentally-friendly locomotives. They have also overhauled thousands of older locomotives to improve their environmental performance.

Some of the new locomotives are fuel-saving “generator set” (*genset*) units for use in rail yards. Gensets have two or three independent engines that cycle on and off depending on need, sharply reducing fuel consumption, pollution, and noise compared to the locomotives they replace. Other switching locomotives are *hybrids* with a small fossil-fueled engine in addition to a bank of rechargeable batteries. Research is ongoing on hybrid long-haul locomotives that would store in batteries the energy generated by braking, and in hydrogen fuel cell switching locomotives.

- *Train handling.* In part, railroad fuel efficiency depends on how well an engineer handles a train. That’s why railroads use the skills of their engineers to save fuel. For example, many railroads offer *training programs* through which engineers and simulators provide fuel-saving tips. On some major railroads, the fuel consumption performance of participating engineers is compared, with awards given to the top “fuel masters.”

In addition, railroads are using sophisticated *on-board monitoring systems* to gather and evaluate information on location, topography, track curvature, train length and weight, and more to provide engineers with real-time “coaching” on the best speed for that train from a fuel-savings standpoint.

- *Information technology.* Many railroads use advanced computer software to improve their fuel efficiency. For example, sophisticated modeling tools identify the best way to sequence cars in a large classification yard. Railroads also use innovative “trip planning” systems that automatically analyze crew and locomotive availability, track congestion, the priority of different freight cars, track conditions, and other variables to optimize how and when freight cars are assembled to form trains and when those trains depart. The result is smoother traffic flow, better asset utilization, and reduced fuel use.
- *Idle reduction technology.* Locomotives often have to idle when not in use to prevent freezing, provide for crew comfort, or for other reasons. However, many railroads have installed idle-reduction technology that allows main engines to shut down under certain conditions. One advantage of genset locomotives is that their smaller engines use antifreeze, allowing them to shut down in cold weather. Railroads also use “auxiliary power units” to warm engines so that locomotives can be shut down in cold weather.
- *Components, maintenance, and design.* Railroads use innovative freight car and locomotive components, maintenance programs, and designs to save fuel. For example, advanced lubrication techniques save fuel by reducing friction; the use of low torque bearings on freight cars and improving the aerodynamic profile of trains save fuel by reducing drag; and the use of “distributed power” (locomotives placed in the middle of trains) can, in certain applications, save fuel by improving operational efficiency.

The seven largest U.S. freight railroads have all joined EPA’s “SmartWay Transport,” a voluntary partnership between freight transporters and the EPA that establishes incentives for fuel efficiency improvements and greenhouse gas reductions. The initiative is designed to reduce annual carbon dioxide emissions by 36 to 73 million tons and nitrogen oxide (NO_x) emissions by up to 220,000 tons. As part of the partnership, each railroad has committed to evaluating the environmental impacts of its operations and agreed to work with the EPA to develop and implement plans to improve fuel efficiency and reduce emissions in coming years.

What Can Policymakers Do Regarding Freight Rail?

Using freight railroads *more* means consuming fuel *less*, and that’s important today more than ever.

Serious capacity issues, however, threaten the ability of railroads to handle socially-optimal amounts of traffic. Freight railroads are reinvesting record amounts of their own funds into their systems, but that will not be enough to take full advantage of railroads’ potential to meet our transportation needs. That’s why we respectfully urge you to support a tax credit for projects that expand freight rail capacity. This would help bridge the funding gap, producing public benefits (like reduced greenhouse gas emissions, reduced highway gridlock, and cleaner air) that would far exceed the cost of the credit.

S. 1125 (the “Freight Rail Infrastructure Capacity Expansion Act of 2007”) calls for a 25 percent tax credit for investments in freight rail infrastructure expansion projects. The AAR gratefully acknowledges the support members of this committee have shown toward S. 1125, and congratulates them on recognizing that a rail investment tax credit addresses the central challenge of how to move more freight without causing more highway gridlock or environmental degradation.

I also respectfully urge you to support S. 881, the “Short Line Railroad Investment Act of 2007,” which would extend the “Section 45G” tax credit for investments in short line track rehabilitation that expired in 2007. The Section 45G tax credit has helped hundreds of short line railroads increase the volume and rate of track rehabilitation and improvement programs, which in turn allows them to offer more efficient, cost-effective, and environmentally-friendly rail service to communities throughout the country.

Finally, the immense public benefits of freight railroading—including lower greenhouse gas emissions and less congested roads and highways—would accrue more quickly if more public-private partnerships for freight railroad infrastructure projects were implemented. Partnerships are not “subsidies” to railroads. Rather, they are an acknowledgement that private entities should pay for private benefits and public entities should pay for public benefits. Partnerships reflect the fact that cooperation between interested entities is far more likely to result in timely, meaningful solutions to transportation problems than a go-it-alone approach.

Climate Change and Passenger Rail

As discussed above, if our goal is to reduce greenhouse gas emissions and highway congestion, transportation policy should emphasize modes of transportation that reduce fuel consumption and take motor vehicles off our congested highways. Railroads offer a fuel efficient, carbon-friendly transportation option for people as well as freight.

In its January 2008 final report to Congress, the National Surface Transportation Policy and Revenue Study Commission stated that “intercity passenger rail is . . . more energy efficient than many other modes of passenger transportation.” The report states that the average intercity passenger rail train produces 60 percent lower carbon dioxide emissions per passenger-mile than the average automobile, and half the carbon dioxide emissions per passenger-mile of an airplane.

BNSF CEO Matt Rose was a member of that Commission. In the final report, Mr. Rose stated that he “shared the conclusion of the Commission’s report that passenger rail—intercity and commuter—will need to grow in order to supplant [vehicle miles traveled] and give Americans more affordable, sustainable choices in light of higher fuel prices, growing transportation congestion and related environmental concerns.”

Mr. Rose, like so many others, realizes that there are substantial public benefits from comprehensive intercity passenger rail. Indeed, the public benefits of a truly attractive and competitive national passenger rail capability will exceed public costs. But in order to be a true transportation alternative for Americans, passenger rail, like freight rail, cannot be achieved on the cheap.

That’s why expanding the capacity of our Nation’s rail infrastructure is a critical challenge that policymakers should address, especially as rising fuel prices are bringing ever-more passengers to railroads. Amtrak ridership may reach 28 million this year—the highest it has ever been and up from 25.8 million passengers last year. In fact, Amtrak ridership and revenues are up in all categories: short distance, long distance, and Northeast Corridor services are all experiencing significant growth. Last month, Amtrak had the highest revenue and ridership of any month in history. Fiscal year 2008 year-to-date ridership is up 11 percent and revenues are up 14 percent over the comparable period in Fiscal Year 2007.

Indeed, as the cost of auto and air travel continue to increase and the prospect of a carbon-constrained future increases, we have an opportunity—and the need—to make far more concerted efforts than we have in the past to more fully capture the economic, environmental, and social benefits of reliable, convenient, and comprehensive passenger rail service.

Unfortunately, without significant investment in capacity expansion—both infrastructure and equipment—Amtrak will not be able to handle all the people that want to use it and we will fail to capture all of those benefits.

For example, Amtrak’s locomotive fleet is antiquated: its diesel switcher locomotive fleet is 40 years old; the average age of the AEM-7 electric fleet is 25 years, and its overhead electric catenary system in the Northeast Corridor is 1930s technology that does not allow Amtrak to take advantage of the improved efficiency of modern converter, transformer, and transmission designs. Passenger cars could be

made lighter and more aerodynamic. These are all areas worthy of government investment that will pay huge dividends over the long term.

Moreover, the implementation of high-speed rail corridors, if done in ways that minimize the substantial operational, engineering, legal, and other impediments that often hinder the ability of freight railroads to accommodate passenger trains, would go a long way in providing a realistic alternative to short-distance air travel and driving for millions of trips per year while significantly reducing the carbon footprint associated with that travel.

In the meantime, Amtrak is committed to working to improve efficiency and reducing greenhouse gas emissions. For example, Amtrak is partnering with the state of Oklahoma on a pilot project to test the use of biofuels in Amtrak locomotives. Amtrak has been approached by another state about a pilot project testing new battery technology in locomotives. Amtrak has long been an industry leader in environmental initiatives as a charter member of the Chicago Climate Exchange (CCX) and the first railroad in CCX, North America's first greenhouse gas emissions trading market. Amtrak has already committed to the largest voluntary emissions reduction plan for diesel fuel use in the United States. In addition, Amtrak passengers can now purchase carbon offsets for their rail trip with Internet ticket purchases.

Conclusion

The key to reducing transportation-related greenhouse gas emissions is reducing fuel consumption in transportation. America's freight and passenger railroads offer a simple, cost-effective and meaningful way to help do this, thereby helping to ensure a sustainable future for our planet.

Senator LAUTENBERG. Thank you very much.

Mr. MEENAN. You're the next witness, please. Go ahead.

STATEMENT OF JOHN M. MEENAN, EXECUTIVE VICE PRESIDENT AND CHIEF OPERATING OFFICER, AIR TRANSPORT ASSOCIATION OF AMERICA, INC.

Mr. MEENAN. Thank you. Today I wanted to focus my remarks on the commercial airlines' outstanding record of greenhouse gas efficiency, our proactive commitment to further limiting our emissions footprint, and the complementary role that Congress can play.

However, I would also note the crippling fuel price crisis the airlines are enduring, which inextricably linked to the broader energy transportation and climate change policies underpinning today's hearing.

We seek your help in ensuring policies that will alleviate this crisis and allow us to get on with our business. A vibrant, competitive, and growing aviation sector is a key part of climate—the climate change solution.

Commercial aviation in the United States has a decidedly strong track record, which is often overlooked or misstated. We contribute just 2 percent of domestic greenhouse gases, compared to 25 percent for the balance of the transportation industry. This is no small achievement, given that commercial aviation is essential to our economy and supports nearly 9 percent of U.S. employment.

Today's airplanes are not just smarter, they're quieter, cleaner, and use less fuel than ever before, because we fly them smarter. U.S. airlines have been able to deliver more value by constantly improving fuel efficiency through reinvestment in technology and more efficient operations. And, in fact, we improved our fuel efficiency by 110 percent between 1978 and 2007, resulting in 2.5 billion metric tons of carbon dioxide savings, roughly the equivalent of taking 18.7 million cars off the road in those years. U.S. carriers burned almost 3 percent less fuel in 2007 than in 2000, but carried 20 percent more passengers and cargo on a revenue/ton-mile basis.

Today, our planes are as fuel efficient as compact cars, but carry more goods and people over six times faster, and our jets are five to six times more fuel efficient than corporate jets.

The Air Transport Association carriers are highly motivated to continue this trend, and have made a commitment to improve fuel efficiency by an additional 30 percent by 2025. Moreover, recognizing that today's carbon-based fuel supply can only take us so far, ATA and its airlines are making extensive resource commitments to stimulate the development of commercially viable, environmentally friendly alternative fuels through the Commercial Aviation Alternative Fuels Initiative. Congress can take action to complement our efforts by ensuring that our Nation's outdated air traffic control system is modernized to permit more direct routes, serving an—saving an additional 10 to 15 percent in fuel and emissions.

Further, we urge Congress to reinvigorate NASA's and the FAA's Environmental Aeronautics Research and Development Programs with specific respect to mitigating the impacts of climate change on aviation. Congress can support data-driven transportation planning that includes airlines, FAA, the airports, and State and local governments.

Finally, and most time critical, we urge Congress to act now to address the fuel price crisis. Even before the recent sustained fuel price spikes, fuel was the airline's largest cost center. Fuel prices now average 30 to 50 percent of an airline's operating expenses, costing between \$41 billion in 2007, projected to grow to \$61 billion this year. I think it's fair to say that the market has long sent a—the commercial airlines the price signal, which some now want to pile onto with cap-and-trade and further limits to the industry's ability to reinvest.

Unfortunately, the last several months, that price signal has turned into a fuel price crisis of epic proportions. This country's airlines expect to lose in the range of \$10 billion this year, a loss on par with that of the worst year in the industry's history. High fuel prices are the sole reason for this situation.

Unlike the temporary revenue hits of 9/11 and other time-demand shocks, the airlines are now facing a massive structural cost increase.

Let me try to add some context. More than 14,000 airline jobs have been cut so far this year, and that's just the tip of the iceberg. Scores of communities stand to lose all scheduled air service by early next year. More airlines, in addition to the nine that have already filed for bankruptcy or stopped operating, will simply shut down.

So, why should this Committee care that the airlines are on the brink of financial disaster—some would say, about to implode? The answer is simple. The Nation's economy is intrinsically linked to the viability of the air transportation system. If the airlines continue to spiral downward, so will the economy. Aviation contributes \$690 billion to the U.S. gross domestic product. That's 10 million new jobs.

So, I take this opportunity at this hearing to ask you again to work with us to address this crisis. And I'd be happy to respond to your questions.

[The prepared statement of Mr. Meenan follows:]

PREPARED STATEMENT OF JOHN M. MEENAN, EXECUTIVE VICE PRESIDENT AND
CHIEF OPERATING OFFICER, AIR TRANSPORT ASSOCIATION OF AMERICA, INC.

Thank you, Mr. Chairman. Air Transport Association (ATA) airline members transport more than 90 percent of all U.S. airline passenger and cargo traffic.¹ Our airlines take their role in controlling emissions very seriously. Recently, there has been a great deal of focus in Congress on greenhouse gas (GHG) emissions in particular, and how this Nation might achieve reductions in these emissions while maintaining economic stability and enhancing energy independence. Commercial aviation has a vital role to play in this regard. Also, as strong supporters of sound transportation planning, the airlines appreciate the Committee's interest in the potential impacts on transportation that might result from changes in climate. Thank you for the opportunity to appear before you today to discuss these issues.

Introduction and Overview

For generations, flying has contributed to a better quality of life in America. Commercial aviation has been essential to the growth of our economy, yielded breakthrough technologies, brought people together and transported critical cargo—all while achieving an exceptional environmental track record. Today's airplanes are not just smarter—they are quieter, cleaner and use less fuel than ever before—but we also fly them smarter. That's why our industry represents just 2 percent of all GHG emissions in the United States while driving three times more economic activity. But we are not stopping there. The initiatives that we are undertaking to further address GHG emissions are designed to responsibly and effectively limit our fuel consumption, GHG contribution and potential climate change impacts while allowing commercial aviation to continue to serve as a key contributor to the U.S. economy. I want to emphasize three points that are essential to moving our emissions-reducing efforts forward within a framework of sound transportation planning, energy and climate change policy:

First, *commercial airlines are and have long been extremely GHG efficient.* For the past several decades, commercial airlines have dramatically improved GHG efficiency by investing billions in fuel-saving aircraft and engines and innovative technologies like winglets and cutting-edge route optimization software. Fuel is our largest cost center, which, long before the current fuel price crisis created the economic imperative that we continuously improve fuel and GHG efficiency. And while commercial aviation accounts for only 2 percent of domestic man-made GHG emissions, we shepherd this to good use, driving a far larger percentage of economic activity, not only directly, but also indirectly, as a necessary element in the airport and tourism sectors and in all business sectors that rely on the rapid delivery of goods and human resources.

Second, *ATA airlines are proactively committed to further limiting their GHG footprint* through a set of measures that will simultaneously address climate change and energy independence while preserving economic stability and the opportunity to grow. At the core of these measures is the ATA carriers' commitment to an additional 30 percent fuel efficiency improvement by 2025—improvement that only comes from the airlines' investment in new aircraft, new aircraft engines, navigation aids and enhanced operational procedures. In addition, we are dedicating ourselves to developing commercially viable, environmentally friendly alternative jet fuel, which could be a game-changer in terms of aviation's output of GHGs. Moreover, we are central stakeholders in partnering efforts to modernize the outdated air traffic management (ATM) system and to reinvigorate research and development in aviation environmental technology, both of which can bring extensive additional emissions reductions.

Third, *there is a critical role for the Federal Government to play in energy, transportation planning and climate change policy* to complement the airlines' efforts. While the ATA airlines' 30 percent fuel efficiency improvement target will be met through the airlines' own investments and operating initiatives, the other measures in the package require a significant measure of congressional support. Also, sound transportation planning at all levels of government can help minimize the impacts on transportation from potential climate change effects.

¹ ATA airline members include ABX Air, AirTran Airways, Alaska Airlines, American Airlines, ASTAR Air Cargo, Atlas Air, Continental Airlines, Delta Air Lines, Evergreen International Airlines, Federal Express Corporation, Hawaiian Airlines, JetBlue Airways, Midwest Airlines, Northwest Airlines, Southwest Airlines, United Airlines, UPS Airlines and U.S. Airways. Associate members are: Air Canada, Air Jamaica Ltd. and Mexicana.

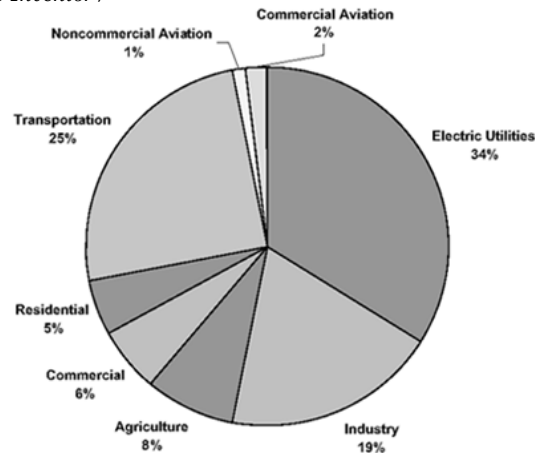
Just as we ask Congress to continue to work with us, we also urge Congress to calibrate Federal energy and transportation policy and any climate change-related legislation so they do not work against our efforts. Last week, ATA announced a revised 2008 forecast: the U.S. airlines expect to lose in the range of \$10 billion this year—a loss on par with the worst year in this industry’s history. Soaring fuel prices are the sole reason. Congress must help get these prices under control. Moreover, while the Senate recently declined to go forward with the GHG cap-and-trade program proposed in the Lieberman-Warner Climate Security Act, which would have applied an additional fuel surcharge on airlines’ jet fuel, we understand that many in Congress still are interested in applying such proposals to aviation. Not only is an additional “price signal” unnecessary for our industry, but recent events have shown the crippling effects that exorbitant fuel prices can have. We urge Congress to adopt sound energy, transportation planning and climate change policies that avoid counterproductive, punitive approaches that further siphon away funds that the airlines otherwise could use to invest in newer aircraft and other fuel- and GHG-saving measures.

Commercial Aviation Is Extremely GHG Efficient

Commercial aviation in the United States has a decidedly strong track record that is often overlooked or misstated. U.S. commercial aviation contributes just 2 percent of domestic U.S. GHG emissions.² To put that into context, with passenger vehicles (cars and light duty trucks) alone accounting for over 17.5 percent,³ as illustrated in Figure 1, road transport accounts for more than a quarter of U.S. GHG emissions and power plants account for over a third.⁴ The picture is similar when viewed on a global basis. Worldwide commercial aviation contributes just 3 percent of man-made GHGs.⁵ To put this into perspective, cattle and other livestock account for approximately 18 percent.⁶

Figure 1—U.S. Aviation Greenhouse Gas Emissions

2 Percent of the Inventory



Source: U.S. EPA Data 2005

At the same time, commercial aviation is critically important to local, national and global economies, enabling a large percentage of U.S. economic output. A July

²The United States Environmental Protection Agency’s (EPA’s) most recent general inventory reports commercial aviation’s contribution to the total GHG emissions in 2006 was 2.04 percent. EPA, *Inventory of Greenhouse Gas Emissions and Sinks: 1990–2006* (April 15, 2008) (hereinafter *EPA GHG Inventory 1990–2006*) at pages ES–4 and 21 (“in 2006, total U.S. greenhouse gas emissions were 7,054.2” teragrams of carbon dioxide equivalent (Tg CO₂ Eq.) and Table 2–15 at pp. 2–22 & 2–23 (“Commercial Aircraft—Domestic” account for 143.6 Tg. CO₂ Eq.).

³EPA GHG Inventory 1990–2006, Table 2–15 at pp. 2–22 and 2–23.

⁴EPA GHG Inventory 1990–2006.

⁵It is estimated that on a worldwide basis, commercial aviation accounts for approximately 3 percent of total GHGs, while at the same time contributing over 8 percent of the world’s economic activity. See International Air Transport Association, *Debunking Some Persistent Myths about Air Transport and the Environment*.

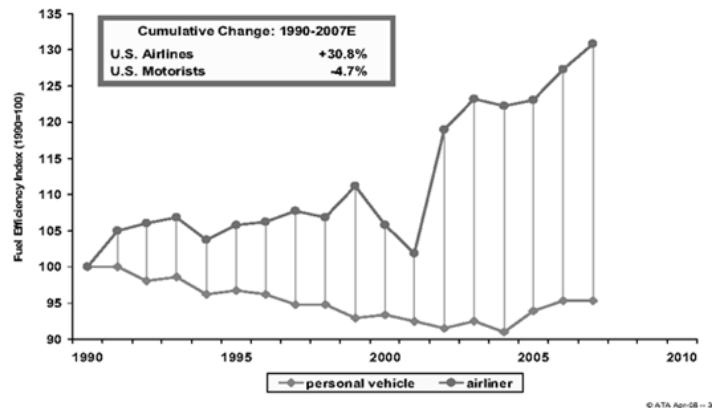
⁶United Nations, Livestock Environment and Development Initiative, *Livestock’s Long Shadow—Environmental Issues and Options* (2006) at p. 271.

2007 study by the FAA found that the national economy is highly dependent on commercial aviation, which is directly or indirectly responsible for 5.2 percent of U.S. gross domestic product (GDP), \$1.1 trillion in U.S. economic activity (gross output), an estimated 9.5 million jobs, and \$322 billion in earnings.⁷ Placing our economic output side-by-side with our GHG output, it is clear that commercial aviation is an extremely GHG-efficient economic engine, bringing good “bang” for our GHG “buck.”

We have been able to deliver such strong economic output while reducing our emissions by continually improving our fuel efficiency through reinvestment in technology and more fuel-efficient operations. In fact, U.S. commercial airlines (passenger and cargo combined) improved their fuel efficiency by 110 percent between 1978 and 2007, which (given the one-to-one relationship between fuel consumption and carbon dioxide (CO₂)) has resulted in 2.5 billion metric tons of CO₂ savings—roughly equivalent to taking 18.7 million cars off the road each of those years. Further, Bureau of Transportation Statistics data confirm that U.S. carriers burned almost 3 percent *less* fuel in 2007 than they did in 2000, resulting in absolute reductions in GHG emissions, even though they carried 20 percent more passengers and cargo on a revenue ton miles basis.

Commercial aviation’s GHG efficiency compares very favorably to other modes and other sectors. While commercial aviation improved its per-passenger fuel efficiency from 1990, freight trucks showed the reverse trend, with GHG emissions growing faster than vehicle miles traveled.⁸ EPA also has confirmed that passenger vehicles have lagged far behind aircraft in fuel and GHG efficiency.⁹ (See Figure 2). Within the aviation sector, it is important to remember that different types of commercial aircraft have vastly different impacts on the environment. Commercial jets are five to six times more fuel efficient than corporate jets. The math is simple: carrying 200 people and cargo across the country in a single plane burns a lot less fuel than 33 separate corporate jets, each flying six people.

Figure 2—In Contrast to Personal Vehicles, Airline Fuel Efficiency Has Improved Substantially Since 1990



U.S. airlines are highly motivated to continue this trend. Fuel, long one of the two highest costs for airlines, is now our largest cost center, averaging between 30 and 50 percent of total operating expenses. In fact, jet fuel costs to the U.S. airlines in 2008 are projected to be \$62 billion or more, breaking the 2007 record of \$41.2 billion, resulting in what some analysts are likening to the economic effects of the 9/11 terrorist attacks.¹⁰ As shown in Figure 3, the price change alone between 2004 and year-end 2008 is the equivalent of 267,000 airline jobs or the purchase price of 286 new narrow-body jets.

⁷ See FAA, *The Economic Impact of Civil Aviation on the U.S. Economy* (July 2007).

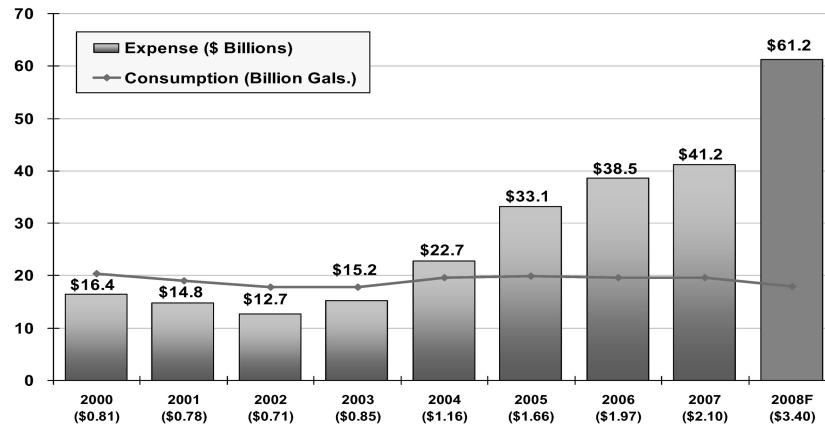
⁸ EPA GHG Inventory 1990–2006 at 3–8.

⁹ *Id.*

¹⁰ See J.P. Morgan Securities North America Corporate Research (April 15, 2008).

Figure 3—2008 Jet Fuel Expense Will Break 2007 Record

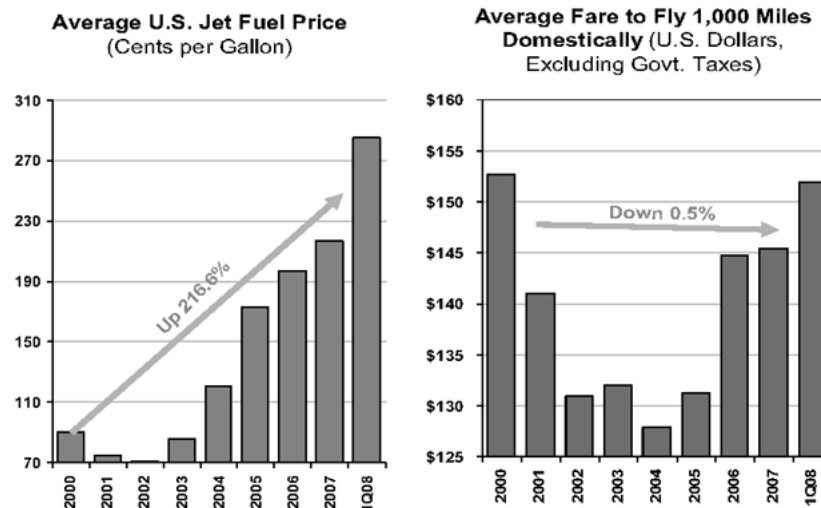
Total Expense (Excluding Taxes and Into-Plane Fees) Will Exceed \$60 Billion



Note: Value in parentheses below year is average price paid excluding taxes, into-plane fees, pipeline tariffs and hedging costs

Sources: ATA, Energy Information Administration, Department of Transportation

And contrary to popular belief, the airlines cannot pass on significant portions of these costs. Indeed, as illustrated in Figure 4, today's U.S. domestic air fares remain below 2000 levels, although fuel prices have tripled. While a slightly more robust international aviation market has allowed today's systemwide fares to increase approximately 3 percent above 2000 levels, this hardly makes up for the three-fold increase in fuel prices over the same period. Thus, we have an unrelenting economic imperative to reduce fuel consumption.

Figure 4—As of Early 2008, Domestic Airfares Remain Below 2000 Levels While Jet Fuel Prices Have Tripled

Source: U.S. Energy Information Administration.

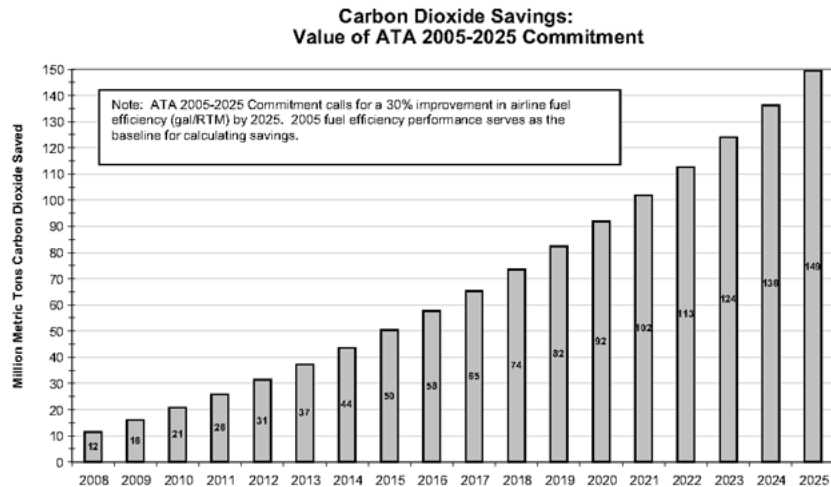
Source: ATA passenger revenue report (mainline + regionals).

ATA Airlines Are Proactively Committed to Further Limiting Their GHG Footprint

In light of the current and sustained fuel price crisis, the U.S. airlines are being forced to put down capacity for air services. Should we be able to get fuel prices

down to more reasonable levels and turn the economy around, we would hope to see a return to growth in U.S. air passenger and cargo services. Under such a scenario, some growth in aviation emissions is predicted. However, this growth must be kept in context. The Intergovernmental Panel on Climate Change (IPCC), which is considered the authority on this issue, has determined that under the most likely scenario, CO₂ from global aviation in 2050 will account for only about 3 percent of total man-made CO₂ emissions and that aviation's overall GHG impact will be around 5 percent.¹¹ Yet even though those remain relatively small numbers, ATA carriers are relentlessly pursuing measures to further limit their emissions footprint.

Figure 5—ATA's 30 Percent Fuel Efficiency Goal Will Translate into CO₂ Savings



At the core of our efforts, ATA carriers have made a commitment to achieve an additional 30 percent systemwide fuel efficiency improvement through 2025, on top of prior improvements. That equates to an additional 1.2 billion metric tons of CO₂ saved—roughly equivalent to taking over 13 million cars off the road each year. (See Figure 5). To accomplish this, our airlines plan to continue the tremendous investments in new equipment and in operational innovations that have allowed us to attain such great fuel efficiency improvements in the past. We are leaving no stone unturned. Some examples of our efforts include:

- *Upgrading Fleets.* Even in the highly constrained financial environment we have been in for some time, ATA airlines have been expending billions to upgrade their fleets through investments in new airframes and engines, removing less fuel-efficient aircraft from their fleets, installing winglets to reduce drag, altering fan blades and other measures aimed at improved aerodynamics. As a critical element of our commitment to achieve an additional 30 percent fuel efficiency improvement by 2025, Boeing estimates that the North American carriers will spend approximately \$730 billion on new aircraft through 2026.¹²
- *Introduction of Innovative, Cutting-Edge Technologies.* Our airlines also are investing millions of dollars in technologies to make existing airframes more efficient. For example, the airlines have undertaken equipage for Required Navigation Performance (RNP) approach procedures, which provide navigation capability to fly a more precise path into an airport. ATA airlines also have developed software to analyze flight paths and weather conditions, allowing aircraft to fly more direct, efficient routes (subject to air traffic approval).
- *Improved In-Flight Operations.* ATA airlines are doing all they can within the existing ATM system to utilize programs to optimize speed, flight path and altitude, which not only reduces fuel consumption and emissions in the air, but avoids wasting fuel waiting for a gate on the ground. In addition to pursuing the use of RNP approach procedures at additional locations, ATA carriers have

¹¹ IPCC, *Aviation and the Global Atmosphere* (1999) at 8.

¹² The Boeing Company (2008).

worked with FAA to pioneer protocols for continuous descent approaches (CDAs), which reduce both emissions and noise, and we are doggedly pursuing implementation of CDAs where the existing ATM system allows.¹³ Further, our carriers are implementing Automatic Dependent Surveillance Broadcast (ADS-B) satellite tracking technology, which avoids the circuitous routings that occur with today's radar-based systems. Demonstrating that the efforts extend to the smallest details of airline operation, our members also have worked on redistribution of weight in the belly of aircraft to improve aerodynamics and have introduced life vests on certain domestic routes, allowing them to overfly water on a more direct route.

- *Improved Ground Operations.* ATA airlines also are introducing single-engine taxiing when conditions permit, redesigning hubs and schedules to alleviate congestion and converting to electric ground support equipment when feasible. Further, they are improving ground operations by plugging into electric gate power where available to avoid running auxiliary power units and using tugs to position aircraft where possible.
- *Reducing Onboard Weight.* ATA airlines continue to exhaustively review ways, large and small, to reduce aircraft weight—removing seat-back phones, excess galley equipment and magazines, introducing lighter seats and beverage carts, stripping primer and paint and a myriad of other detailed measures to improve fuel efficiency.

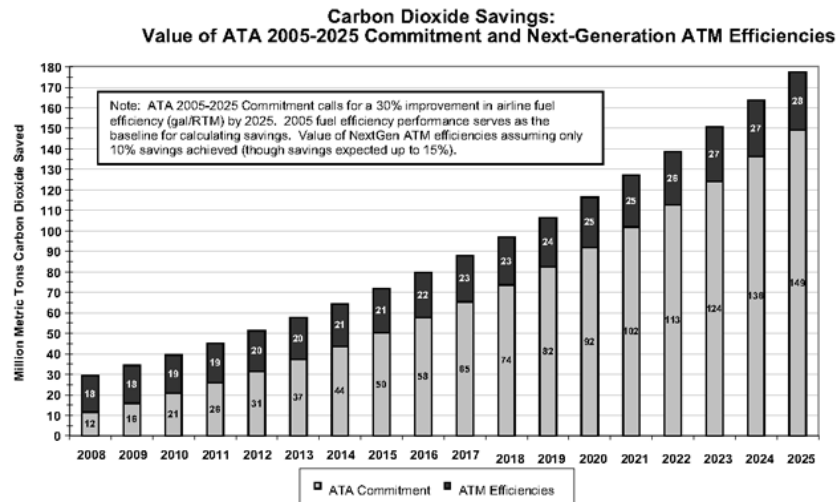
Second, recognizing that improving fuel efficiency with today's carbon-based fuel supply can only take us so far, ATA and its airlines are making extensive resource commitments to stimulate the development of commercially viable, environmentally friendly alternative fuels. As a framework for doing this, we are a founding and principal member of the Commercial Aviation Alternative Fuels Initiative (CAAFI), a consortium of airlines, government, manufacturers, fuel suppliers, universities, airports and other stakeholders who hold the various keys to research, development and responsible implementation of alternative jet fuels. Developing alternative jet fuels is a "higher hurdle" than developing alternative fuels for ground-based units, as jet fuel must meet rigorous FAA specifications, which include reliability and stability at altitude and in greatly varying temperature and pressure conditions to ensure safety. Thus, absent a cooperative initiative like CAAFI, fuel providers almost certainly would not undertake the investments needed to clear this higher hurdle, opting instead for the surer payoff at ground level.

While each entity involved in CAAFI has a role to play, our airlines understand that—as end users of the ultimate product—they must not only make clear their specifications for alternative jet fuels, but also signal the market that we will financially back fuels meeting those specifications. On Earth Day this year, the ATA Board of Directors took another significant step in this regard, issuing the "ATA Alternative Fuels Principles Document." Among other things, that document stipulates that ATA carriers require that any future alternative jet fuel be more environmentally friendly, on a life-cycle basis, than the jet fuel available today. Through CAAFI and other partnerships, we are undertaking the work to be sure that tomorrow's alternative jet fuel meets that criterion. And accomplishing that will ensure the full decoupling of growth in aviation demand from growth in GHG emissions.

Third, while ATA airlines are doing all that they can to promote efficiencies within the current ATM system, the limitations of that system account for 10–15 percent of unnecessary fuel burn and resulting emissions. To address this, and to achieve much-needed modernization of our outdated ATM system, ATA and its carriers are working with FAA and other agencies on a fundamental redesign of the system through the Next Generation Air Transportation System (NextGen) project and on various regional airspace design initiatives. ATA is supporting this modernization initiative through our "Smart Skies" program.¹⁴ However, congressional approval, including fair and equitable distribution of costs among all system users, is needed before significant progress can be made in implementing this system. Congressional authorization and implementation of this initiative will bring 10–15 percent additional savings on top of the ATA 30 percent commitment. (See Figure 6).

¹³For example, one ATA carrier is achieving an average savings of 1,300 pounds of CO₂ savings per flight for approaches into the Atlanta airport.

¹⁴"Smart Skies" is a national campaign led by ATA airlines, which advocates modernization of the U.S. ATM system and its funding mechanisms. For more on this initiative, see the Smart Skies website, at <http://www.smartskies.org>.

Figure 6—CO₂ Saved Under ATA and NextGen Initiatives*(As if NextGen Implemented in a Given Year)*

Fourth, at the same time ATA and its members are pushing the envelope with existing technology, we continue to contribute to work that will advance new technology. For example, ATA participates in key, joint government/stakeholder initiatives, including the Steering Committee of the Partnership for AiR Transportation Noise & Emissions Reduction (PARTNER) and the Environment and Energy Subcommittee of the FAA Research Engineering and Development Advisory Committee. While additional evolutionary environmental improvements are in the pipeline as a result of such initiatives, revolutionary environmental breakthroughs can only come about through the reinstatement of significant Federal investments in basic aeronautics research and development programs at NASA and FAA. Indeed, Pratt & Whitney's new geared turbofan engine, which offers both noise and emissions benefits, as well as many features of Boeing's more environmentally efficient 787 were spawned through such programs. As we have noted in other contexts, however, congressional funding to NASA and FAA for aeronautics research and development—specifically including for environmental projects—has been cut significantly (by about 50 percent) in the past 8–10 years, compromising the public-private partnership for exploring and bringing to market products with significantly improved environmental performance.¹⁵ Thus, we continue to urge Congress to provide this needed funding, which also is critical to preserving America's competitiveness in aeronautics.

Congress Should Complement the Airlines' Initiatives, Through Sound Energy, Transportation Planning and Climate Change Policies

We are confident that the measures ATA is undertaking and supporting will continue to limit and reduce aviation's emissions footprint, such that commercial aviation will remain a very small source of GHG and other emissions. However, Congress has a key role to play. First, as noted, congressional approval for implementation of a modernized ATM system is critical, as is reinstatement of funding for re-

¹⁵ While later funding cuts were even more drastic, a 2002 study by the National Academy of Sciences observed:

In constant year dollars, NASA funding for aeronautics research was cut by about one-third between 1998 and 2000, reducing the breadth of ongoing research and prompting NASA to establish research programs with reduced goals, particularly with regard to TRL (technology readiness level). This significantly reduces the likelihood that the results of NASA research will find their way into the marketplace in a timely manner, if at all. The ultimate consequence is that the Federal expenditures are inconsistent with the long-term goal of support for an aviation enterprise compatible with national goals for environmental stewardship.

See National Academy of Sciences, Committee on Aeronautics Research and Technology for Environmental Compatibility, *For Greener Skies: Reducing Environmental Impacts of Aviation* at 44 (2002).

search and development programs to foster aviation environmental technology breakthroughs. Further, while Congress generally is supporting several alternative fuel research programs, specific support and funding should be provided for the development of environmentally friendly alternative jet fuels. Thus, while a central focus of today's hearing is on how climate change may impact transportation and transportation infrastructure, we must also remain focused on how improving air transportation infrastructure can help minimize the very GHGs of concern.

As this Committee is aware, in March 2008 the Transportation Research Board issued a special report on the "Potential Impacts of Climate Change on U.S. Transportation." That report identified threats that aviation (as well as other modes of transport) may face under certain climate change scenarios. Many of the recommendations called for further coordination among Federal, state and local agencies in conducting research and transportation planning to mitigate climate change impacts. ATA strongly supports data-driven, coordinated transportation planning, which can help ensure cost-effective deployment of resources. To this end, we work closely with FAA, state governments, the airports and local communities in aviation-related transportation research and planning. Congress should continue to support FAA's role in such planning initiatives.

Just as we ask Congress to work to complement airline GHG initiatives, we also urge Congress to calibrate Federal energy policy and any climate change-related legislation so they do not work against our efforts. As noted, ATA's recently revised 2008 forecast shows that the country's airlines are likely to lose in the range of \$10 billion this year—a loss on par with the worst year in this industry's history, with soaring fuel prices as the sole reason. Congress must help get these prices under control. The \$62 billion (plus) that the airlines will spend on fuel this year is at least \$20 billion more than last year and slightly more than our combined fuel bill for the first 4 years of this decade. Sadly, 2008 could turn out to be the worst year in the industry's history. Unlike the temporary revenue hits from SARS, 9/11 and other one-time demand shocks, the airlines now are facing a massive structural increase—with no end in sight—in a virtually uncontrollable cost. Moreover, there is little low-hanging fruit left to harvest. Unfortunately, not even Chapter 11 can lower the price of fuel.

To many Members of Congress, \$10 billion is not a lot of money. Let me add some context. More than 14,000 airline jobs have been cut so far this year, and that is just the tip of the iceberg. By cutting capacity, scores of communities stand to lose all commercial air service by early next year. Orders for new planes have been slashed and hundreds of older, less efficient planes have been taken out of service. We are burning through cash at unprecedented rates, barely surviving from month to month. The nation's airlines will never fully recover from this economic blow, and more airlines—in addition to the nine that already have filed for bankruptcy or stopped operating—may simply shut down. That means even more job losses and untold harm to families and the economy.

Committee members and Congress, for that matter, may ask why the country should care that its airlines are on the brink of financial disaster and—some would say—about to implode. The answer is simple: this Nation's economy is inextricably linked to the viability of its air transportation system. If the airlines continue to spiral downward, so will the economy. Aviation contributes \$690 billion to the U.S. GDP—that's equal to heating oil costs for 376 million households for one winter, 24 million new cars and 10 million new jobs.

If Congress does not turn things around very soon, the impact on the country's economy will be even worse. Analysts are predicting that a 20 percent reduction in capacity may not be enough to save the industry. Based on the communities that stand to lose service, airline hubs will be decimated, tens of thousands more jobs will be eliminated and tourist destinations will be devastated by huge cuts in the number of flights. Realistically, rural areas will be hit the hardest by the cuts, leaving thousands of square miles without air service.

Not only must Congress act with sound energy policy, but it also must forbear from adopting climate change policies that would further exacerbate the fuel price crisis. While the Senate recently declined to go forward with the GHG cap-and-trade program proposed in the Lieberman-Warner Climate Security Act, which would have applied an additional fuel surcharge on airlines' jet fuel, we understand that many in Congress still are interested in applying such proposals to aviation. Not only is an additional "price signal" unnecessary for our industry, but recent events have shown the crippling effects that exorbitant fuel prices can have. We urge Congress to avoid counterproductive, punitive approaches that further siphon away funds that the airlines otherwise could use to invest in newer aircraft and other fuel- and GHG-savings measures.

Conclusion

I close by asking you to note the achievements that commercial airlines have made in reducing fuel burn and GHGs, particularly when compared to other industries, and the actions that we are taking to continue our progress in this regard. While we are fully committed to working with Congress and are asking for congressional leadership and support in each of the areas I have described, we are not asking you to work for us, we're asking you to work with us in addressing these environmental, energy and transportation concerns. We also are urging you to refrain from adopting policies that would work against our efforts. A vibrant, competitive and growing aviation sector is a key part of the solution, not an impediment to ensuring a future where a strong economy, freedom from foreign oil and cleaner air are the order of the day.

Senator LAUTENBERG. Thank you, Mr. Meenan. We do care, obviously. And we thank you for your testimony.

And now, Mr. Treadwell?

STATEMENT OF MEAD TREADWELL, CHAIR, U.S. ARCTIC RESEARCH COMMISSION

Mr. TREADWELL. Good afternoon, Mr. Chairman, Mr. Vice Chairman. Thank you for having me here today.

On behalf of my fellow U.S. Arctic Research Commission commissioners, this is a very important thing to consider in a hearing on climate and transportation, is the Arctic.

During this International Polar Year, the United States and other nations are laying down an Arctic Observing Network to better understand, model, and predict the vast changes coming to the northern part of the globe. This hearing has been focusing both on climate and its effects on transport, and then transport and its effects on climate.

The Interagency Arctic Research Policy Committee, acting on our Commission's recommendation, has commissioned an Interagency Research Plan on Arctic Infrastructure, in light of climate change. And this will cover many climate impacts on transportation in the Arctic, including roads, maritime transport, and the need for improved oil-spill research in ice-covered waters.

I'm going to focus, today, however, on shipping. The Arctic Council's eight nations with indigenous participants in the global shipping industry are conducting an Arctic Marine Shipping Assessment, due to be published in 2009. I've given you a brochure about that assessment. While science is finding the Arctic to be suddenly and surprisingly accessible, our assessment is finding that regular Arctic ocean shipping tied to specific resource development projects, tourism, or serving the needs of Arctic communities is large now, and is growing. For the United States, it's necessary to recognize the Alaska purchase in 1867 made us an Arctic nation. Great circle air routes through the Arctic currently carry the bulk of travelers and air cargo between these continents. Today's Arctic infrastructure is global infrastructure.

In the 21st century, Arctic seaways have the potential to serve as a major venue for shipping between these continents, as explorers envisioned as early as 500 years ago. Much of our work as a Commission is to ensure that the U.S. Government does its homework—homework we believe is necessary in response to an accessible Arctic Ocean.

Let me focus on five points and direct the Committee to sources of additional information.

First, climate is changing to create an accessible Arctic. Sea-ice coverage is reducing in both area and thickness faster than our climate models predicted. This, combined with the advent of more efficient ice-breaking technology and global demand for Arctic resources, works to make Arctic shipping more economically feasible and attractive to investors. In a set of slides I've given you, we can show the ice minimums in 2002 and what they've receded to 2007, and a second set of slides explains some changes in shipping technology, ice-breaking technology that—they're making icebreakers are more efficient.

Second, Arctic residents, governments, and industry are assessing both the opportunities and the challenges of an accessible Arctic. Within these assessments is a fundamental question. Will trans-Arctic seaways be as important to global shipping as the Panama and Suez Canals, or will the Arctic Ocean continue more as a venue for shipping in and out of the Arctic itself, for tourism, local needs, and bringing natural resources to market?

Third, policies are being conceived, developed, and implemented toward a goal of ensuring that shipping in the Arctic is, to quote my colleague at the Department of State, Assistant Secretary Dan Sullivan, "safe, secure, and reliable." To me, those three words have large meanings. "Safe" refers to protecting human life and mitigating any ill effects shipping will have on the environment, biodiversity, cultures, and traditions of the Arctic. Likewise, navies and coast guards must expand their capacity to ensure security for those ships, particularly those carrying strategic commodities. And finally, the word "reliable" refers to issues raised by the shipping industry itself. The Arctic Ocean is a patchwork quilt of tolls and regulations by several coastal nations. The U.S. Arctic Research Commission continues to urge the Senate to accede to the United Nations Convention on Law of the Sea, which will help set some of the rules in the Arctic related to shipping.

Fourth, strong research programs are needed in the Arctic Ocean, and some of that research is on deadline. Decisions to be made by governments on climate issues require an understanding of what is happening in the Arctic Ocean, the Greenland Ice Cap, and the changing heat, freshwater, and greenhouse gas budgets of the Earth. There are several wildcard issues related to Arctic shipping identified through the AMSA process, and these include understanding the effects of air pollution and noise from ships on the ecosystem.

Finally, and fifth, an accessible Arctic means a need for investment. Your Committee, Mr. Chairman, has recognized that and reported legislation calling for construction of two new polar-class icebreakers for the Coast Guard and the Nation while maintaining the existing fleet in working condition. We believe these ships will be used, as they are now, as research platforms and as the visible U.S. maritime presence in these regions. But, the advent of Arctic transportation means the other, more traditional missions of the Coast Guard will take center stage. And these ships are needed to provide the same protections U.S. Coast Guard affords the rest of

the Nation—search and rescue, law enforcement, border protection, environmental protection, and spill response.

An accessible Arctic also means new, expanded routes for U.S. military sealift to move assets from one part of the world to the other. In Coast Guard, our polar icebreakers are an essential component to guarantee this polar maritime mobility exists.

Mr. Chairman, to conclude, we understand it's our Nation's goal, expressed with other nations, to reverse the trend of climate change caused by humans. In the Arctic, research to support adaptation to, and mitigation of, climate change is high on our agenda. But, as more forces than climate are working to produce an accessible Arctic, it's essential our Nation act now. Under the principle of freedom of navigation, global shipping could come to our doorstep, whether we invite it or not. And whether you envision the Arctic Ocean as an—as a new seaway for trans-Arctic shipping, competitive with Panama and Suez Canals, or only foresee an expansion of the current shipping in and out of the Arctic, the time to prepare is now.

Thank you very much.

[The prepared statement of Mr. Treadwell follows:]

PREPARED STATEMENT OF MEAD TREADWELL, CHAIR,
U.S. ARCTIC RESEARCH COMMISSION

Good morning, Mr. Chairman, Mr. Co-Chairman, and Members of the Committee. My name is Mead Treadwell. Since 2006, I have chaired the U.S. Arctic Research Commission (USARC).¹ As a senior fellow at the Institute of the North, based in Anchorage, Alaska, and in the private sector, I have worked for much of my career on the economics, feasibility, and sustainability of Arctic transportation in shipping, pipelines, railroads, tourism and aviation.²

On behalf of my fellow Commissioners, thank you for your invitation to be here today. The Arctic component to this hearing is essential. During this International Polar Year, the United States and other nations are laying down an Arctic Observing Network³ to better understand, model and predict the vast changes coming to the northern part of the globe. The Arctic Council's eight nations, with indigenous participants and the global shipping industry, are conducting the Arctic Marine Shipping Assessment, due to be published in 2009.⁴ While science is finding the Arctic to be suddenly, and surprisingly accessible, our assessment is finding that regular Arctic Ocean shipping, tied to specific resource development projects, tourism, or serving the needs of Arctic communities is large now, and is growing.⁵ New Arctic-capable ships are under construction in Southeast Asia and Europe. That trend

¹Under the Arctic Research and Policy Act of 1984, the seven Commissioners of the USARC are appointed by the President and report to the President and the Congress on goals and priorities for the U.S. Arctic Research Program. That program is coordinated by the Interagency Arctic Research Policy Committee, (IARPC) chaired by National Science Foundation Director Dr. Arden Bement, who is also an *ex-officio* member of the Commission. See www.arctic.gov for Commission publications, including the Commission's 2007 Goals Report.

²The Institute of the North, www.institutenorth.org, founded by former Alaska Governor and U.S. Interior Secretary Walter J. Hickel, has programs that focus on economics and policy related to management of common resources, onshore and offshore. Our work in Arctic infrastructure (including energy, transportation and telecommunication) supports the work of the eight-nation Arctic Council and the circumpolar, regional governments of the Northern Forum. Our defense, security and geography studies stem from Alaska's unique, strategic location.

³AON report is here: <http://www.nsf.gov/od/opp/arctic/iarpc/start.jsp>. Pending legislation to support the Integrated Ocean Observing System is needed to assure that studies of Arctic climate changes will be initialized and maintained. These are important to understand the processes that affect the ice cover and circulation of the Arctic Ocean and thus shipping.

⁴AMSA is led by the U.S., Canada, and Finland, and is Chaired by Dr. Lawson Brigham, Deputy Director of the U.S. Arctic Research Commission, a former U.S. Coast Guard icebreaker captain. For details on AMSA. See: <http://arcticportal.org/pame/amsa>.

⁵See slides, attached, and the website for June 5, 2008 Arctic Transportation Conference sponsored by DOT/MARAD. See: <http://www.marad.dot.gov/Arctic%20Conference/Arctic%20index.html>

brings with it the need for new policies—rulemaking, research, and investment—by governments of the Arctic region.

In the United States, it is necessary to recognize that the Alaska Purchase in 1867 made us an Arctic nation. Our ocean boundaries are more than the Atlantic and Pacific. In the 20th century, the advent of aircraft, missiles, and missile defense made the Arctic region a major venue for projection of power and a frontier for protecting the security of North America, Asia and Europe. Great circle air routes through the Arctic currently carry the bulk of travelers and air cargo between these continents. Today's Arctic infrastructure is *global* infrastructure. In the 21st century, Arctic seaways have the potential to serve as a major venue for shipping between these continents, as explorers envisioned as early as 500 years ago.

Much of the U.S. Arctic Research Commission's work is to encourage the U.S. Government to do its homework—homework that is necessary in response to an accessible Arctic Ocean.⁶ In today's testimony, I will focus on five points, and direct the Committee to sources of additional information.

First, *climate is changing* to create an *accessible Arctic*. Sea ice coverage is reducing in area and thickness faster than our climate models predicted.⁷ This, combined with the advent of more efficient icebreaking technology, and global demand for Arctic resources, works to make Arctic shipping more economically feasible and attractive to investors.⁸

Second, Arctic residents, governments and industry are assessing both the opportunities and the challenges of an accessible Arctic.⁹ Within these *assessments* is a fundamental question: Will trans-Arctic seaways be as important to global shipping as the Panama and Suez Canals? Or, will the Arctic Ocean continue more as venue for shipping in and out of the Arctic itself, for tourism, local needs, and for bringing natural resources to market?

Third, *policies are being conceived, developed and implemented* toward a goal of ensuring that shipping in the Arctic is, to quote my colleague at the Department of State, Assistant Secretary Dan Sullivan, "safe, secure and reliable."¹⁰ To me, those three words have large meaning. *Safe* refers to protecting human life, and mitigating any ill effects shipping will have on the environment, biodiversity, cultures and traditions of the Arctic. Likewise, navies and coast guards must expand their capacity to ensure *security* for those ships, particularly those carrying strategic commodities. Finally, the word *reliable* refers to issues raised by the shipping industry. The Arctic Ocean is a "patchwork quilt" of tolls and regulations by several coastal nations. Arctic shipping will grow when rules are certain and when products can be delivered competitively with other routes. This means on a time and cost basis, not just on shorter distances.

Mr. Chairman, a regime for safe, secure, and reliable shipping is something our Nation can lead in developing, through existing mechanisms like the International Maritime Organization, the Arctic Council, and—when acceded to by the U.S.—via the Law of the Sea convention. The U.S. Arctic Research Commission continues to urge the Senate to accede to this convention.

The United States last revised its Arctic policy in 1994. While environmental protection was then made a principal objective, climate change and growth in Arctic shipping were not contemplated.¹¹ As the Executive Branch currently conducts a review of U.S. Arctic policy, the Commission has urged consideration of policies to ensure safe, secure, and reliable shipping.

Fourth, strong *research programs* are needed in the Arctic Ocean, and some of that research is on deadline. The U.S. Arctic Research Commission has developed a set of research goals related to shipping, and those goals will be included in the report due to Congress in 2009. Decisions to be made by governments on climate issues require understanding of what is happening in the Arctic Ocean, the Greenland icecap, in the changing heat, freshwater and greenhouse gas budgets of the earth.

⁶See USARC's summary report on goals and objectives for Arctic research 2007 for the U.S. Arctic Research Plan, www.arctic.gov.

⁷See National Snow and Ice Data Center's website at: <http://nsidc.org/arcticseaicenews/>.

⁸See slides, attached.

⁹See AMSA: <http://arcticportal.org/pame/amsa> and Arctic Shuttle Container Link Study conducted for the State of Alaska and the Port of Adak by the Institute of the North and Aker Arctic. See: <http://www.institutenorth.org/servlet/content/studies.html>. Also see the Sept. 2004 Arctic Marine Transport Workshop report here: <http://www.institutenorth.org/servlet/content/reports.html>.

¹⁰See: http://www.nytimes.com/2007/10/19/us/19arctic.html?_r=1&scp=1&sq=shipping%20Arctic%20sullivan&st=cse&oref=slogin.

¹¹The current State Department summary on Arctic Policy lists the six principal objectives of Arctic Policy. See: <http://www.state.gov/g/oes/ocns/arc/>.

Several “wild card” issues related to Arctic shipping have been identified through the AMSA process and will be included in the Commission’s goals for shipping research as part of the 2009 report. These include understanding the effects of air pollution and noise from ships on the Arctic ecosystem. As well, the tradeoff between warming effects of ship emissions in the Arctic and potential reduced emissions from shipping worldwide, due to shorter routes, is a goal of study. Also, the U.S. and Iceland are cooperating on development of hydrogen technologies. The prospect of hydrogen-powered ships, under development by Iceland, is of interest to the entire Arctic community.

The Interagency Arctic Research Policy Committee, acting on the USARC’s recommendation, has commissioned an interagency research plan on Arctic infrastructure, in light of climate change. This will cover many climate impacts on transportation in the Arctic, including roads, maritime transport, and the need for improved oil spill research in ice-covered waters.¹²

Nations are mustering bathymetric and seismic expeditions to delineate the extended continental shelf of the Arctic region, for new territorial claims allowed under the United Nations Convention on the Law of the Sea (UNCLOS). And as those claims by some nations could make parts of the Arctic Ocean legally less accessible to research, the science community is pressing to ensure greater access with the diplomatic community.¹³

Fifth and finally, an accessible Arctic means a need for *investment*. Your Committee, Mr. Chairman, has recognized that, and reported legislation calling for construction of two new Polar class icebreakers for the Coast Guard and the nation,

¹² Under the leadership of the U.S. Army Corps of Engineers’ Cold Region Research and Engineering Laboratory, in Hanover, N.H., the plan will cover research and development goals for civil works and housing (including permafrost and shoreline erosion), oil spills, energy use, and marine transportation.

¹³ The USARC has been informed by the Department of State that applications from the U.S. to Russia for approval to conduct marine scientific research in Russia’s Exclusive Economic Zone was denied 11 of the 13 times requested between 1996 and 2006, and 6 of the 14 times between 1992 and 1995 (Personal communication to the Chair and Executive Director of the USARC, April 7, 2008).

See also this appeal was submitted by the USARC, and others, to the U.S. Department of State.

*Appeal to the U.S. Department of State
In anticipation of the meeting of ministers from the five Arctic coastal nations
in Ilulissat, Greenland, on May 28, 2008*

As you, representing the United States, meet with representatives from other Arctic coastal states, to discuss the future of the Arctic Ocean, we, representing the U.S. science community working in this region, make this appeal: please take all necessary effort to enable research to thrive by ensuring free and open scientific access to the Arctic. The open nature of the Antarctic Treaty, and the free support of and exchanges in science, have been the hallmark of international cooperation on that continent for 50 years. The Arctic also would benefit from such openness.

We especially urge the coastal Arctic states to remove obstacles to ship access for research in the Arctic Ocean. In recent years, important scientific expeditions have been canceled through parts of the Arctic due to the expense and complications of national rules for foreign ships wishing to enter the Exclusive Economic Zone of certain Arctic nations. Further, some ships—whose voyages were solely dedicated to research—have been categorically denied access. We are concerned that Arctic nations’ expanded jurisdiction of the ocean floor, that will come about through Law of the Sea claims, threatens to further limit the full range of customary research activities that need to be conducted by scientists in the Arctic. Although it may be useful to ensure rights of inspection for such vessels, there are many benefits to be derived from open access for scientific purposes.

Second, please address the well-documented need for sharing of data that has been, or will be, collected in the Arctic Ocean region. We appeal to nations to continue to make available previously collected data, and to commit to further sharing of new data collected within jurisdictional borders.

Knowledge gained from Arctic research is important to the entire world. Policy decisions on climate change, energy, environment, human health, security, commerce, and other subjects will be made by many nations based on this knowledge. Scientific research should be based on sound conclusions drawn from valid data, unfettered by national borders.

Thank you for your attention to these issues. We wish you a productive meeting.

Signed by the following four organizations:

- *Arctic Research Consortium of the U.S.* (www.arcus.org), representing over 5,000 scientists worldwide from 51 member institutions
- *Consortium for Ocean Leadership* (www.oceanleadership.org) representing over 10,000 scientists from 95 member institutions in the U.S. and Canada
- *Marine Mammal Commission* (www.mmc.gov)
- *U.S. Arctic Research Commission* (www.arctic.gov)

while maintaining the existing fleet in working condition.¹⁴ The U.S. Arctic Research Commission has urged the President and Congress to move expeditiously in building and maintaining those ships. Certainly, they will be used as they are now—as research platforms and as the visible U.S. maritime presence in both polar regions. But the advent of Arctic transportation means the other, more traditional missions of the Coast Guard will take center stage. These ships are needed to provide the same protections the U.S. Coast Guard affords the rest of the nation: search and rescue, law enforcement, border protection, environmental protection and oil spill response.¹⁵

Aid to commerce is an important mission of our Great Lakes icebreakers. Under a regime worked out with Canada, the St. Lawrence Seaway/Great Lakes system has become an important part of the global transportation network. The Executive Order signed by President Franklin Roosevelt, committing icebreakers to support U.S. maritime commerce could apply to the U.S. Arctic as well.¹⁶

Polar class icebreakers also support the essential mission of national presence in the Arctic and the Antarctic, both in maintaining our position and in supporting freedom of navigation. Indeed, an accessible Arctic Ocean also means new or expanded routes for the U.S. military sealift to move assets from one part of the world to another. Coast Guard polar icebreakers are an essential component to guarantee that this U.S. polar maritime mobility exists.

Shipping and research activities in the Arctic depend today on a strong system to predict ice conditions, provided by satellites above, and analysis by our Navy/NOAA/Coast Guard National Ice Center, near here in Suitland, Maryland. Current activity in the Arctic depends on good meteorology, developed in cooperation with our neighbors. Appropriate spill response and search and rescue require additional investment. My predecessor, George Newton, as Chair of the USARC has spoken of the necessity for an “Arctic 911” capability, and led the effort to encourage the National Geospatial Intelligence Agency (NGA) to add the Arctic region to the oceans of the world supported by notices to mariners. The question of where we need new port facilities, as safe harbors and transshipping points, is yet to be fully addressed.

Mr. Chairman, to conclude, we understand it is this Nation’s goal—expressed with other nations—to reverse the trend of climate change caused by humans. In the Arctic, research to support adaptation to and mitigation of climate change is high on our agenda. But as more forces than climate are working to produce an accessible Arctic, it is essential that our Nation act now. Research, policies and coordinated investment in infrastructure will ensure safe, secure, and reliable Arctic shipping. Under the principle of freedom of navigation, global shipping can come to our doorstep whether we invite it or not. Whether you envision the Arctic Ocean as a new seaway, for trans-Arctic shipping, competitive with the Panama and Suez Canals, or only foresee an expansion of the current shipping in and out of the Arctic, the time to prepare is now.

Thank you very much.

Senator LAUTENBERG. Thank you very much.

The testimony is impressive, and I thank each one of you for your contribution.

¹⁴ See USCG authorization bill reported in the Senate: <http://thomas.loc.gov/cgi-bin/query/D?c110:2::/temp/c110UjJuKU>.

¹⁵ See attached letter March 18, 2008 from Alaska Governor Sarah Palin to President Bush. See also the attached memorandum for the Joint Chiefs of Staff that was received by the USARC on June 8, 2008. Both documents refer to national needs for new icebreaker capacity. The 2006 National Research Council’s study “Polar Icebreakers in a Changing World: An Assessment of U.S. Needs” can be accessed here: http://www.nap.edu/catalog.php?record_id=11753.

¹⁶ See: <http://www.conservativeusa.org/eo/1936/eo7521.htm> Ex. Ord. No. 7521. Use of Vessels for Ice-breaking Operations in Channels and Harbors. Ex. Ord. No. 7521, Dec. 21, 1936, 1 F.R. 2527, provided: 1. The Coast Guard, operating under the direction of the Secretary of the Treasury, is hereby directed to assist in keeping open to navigation by means of ice-breaking operations, in so far as practicable and as the exigencies may require, channels and harbors in accordance with the reasonable demands of commerce; and to use for that purpose such vessels subject to its control and jurisdiction or which may be made available to it under paragraph 2 hereof as are necessary and are reasonably suitable for such operations. 2. The Secretary of War (Army), the Secretary of the Navy, and the Secretary of Commerce are hereby directed to cooperate with the Coast Guard in such ice-breaking operations, and to furnish the Coast Guard, upon the request of the Commandant thereof, for this service such vessels under their jurisdiction and control as in the opinion of the Commandant, with the concurrence of the head of the Department concerned, are available and are, or may readily be made, suitable for this service.

I want to ask Mr. Friedman a question. Concerns about whether ethanol is actually better than gasoline, in terms of its emissions of greenhouse gases. Do you think we should put stronger requirements on greenhouse gas emissions from ethanol producers?

Mr. FRIEDMAN. Thank you, Mr. Chairman.

Well, basically, we need strong greenhouse gas requirements on every fuel that is used in transportation. The science on the global warming reductions associated with ethanol is continuing to evolve. What we're learning is that corn ethanol may not be as good for the climate as we once thought. Both for those reasons and for concerns about food prices, we need to basically evolve from corn as an ethanol source, to waste products, to wood products in order to produce ethanol. These so-called cellulosic ethanol resources, if done sustainably, can dramatically cut global warming pollution and can be part of a broader solution that includes renewable electricity and clean hydrogen, but we're not going to get these solutions unless we have a low carbon fuel standard, a policy that is going to require all fuels to get better over time. And we probably also won't have this unless we make sure we have the vehicles out there—the plug-in hybrids, the fuel-cell vehicles, the electric vehicles—that can use these cleaner energy resources.

Senator LAUTENBERG. Let me ask you—you identify corn for the problems that it creates and—by way of shortages and other things—forgive me, they've managed to break the code here—

[Laughter.]

Senator LAUTENBERG.—and is there any improvement, vis-à-vis emissions, if sugar ethanol is introduced? Is that substantially more efficient? I heard what you said. You said all fuels should be examined for—

Mr. FRIEDMAN. It does look like sugar-based ethanol—for example, the sugar cane used in Brazil—can be reduce global warming pollution. But, even there, anytime we talk about using a crop to make fuel, we need to make sure that, by using that crop for fuel instead of food, we're not encouraging someone somewhere else to cut down a forest to replace that fuel. That's the real dynamic that we have to avoid here.

So, some sugar-based ethanol could make a lot of sense; but, too much, and it may actually contribute to either deforestation or clearing of land that could actually generate more global warming pollution than you could save.

Using food for fuel is a tricky proposition, and it's definitely something that, I think, with good investment in cellulosic ethanol, especially from waste products, that we can move away from over time. It can potentially form the base for what we're doing right now.

Senator LAUTENBERG. Is the technology available to make the conversion to using waste products to fuel the development of ethanol—to the point now that it can be done in the volumes that matter?

Mr. FRIEDMAN. Well, thankfully, we're about to find out. There has been significant investment in cellulosic ethanol plants—in part, funded by the Department of Energy and work by Congress—but right now we don't have large-scale production of those fuels; it's probably going to take several years before we will see if we

can, for example, get cellulosic ethanol for only, say, \$2.00 a gallon. If we get the breakthroughs we need, it will become one of the added biofuel resources.

Senator LAUTENBERG. But, the union is concerned about the time that we have to make changes in global warming—significant changes—and asked for far larger reductions than almost any other really responsible organization. If we don't have the ability to produce products in sufficient volume for several years, it doesn't sound like we're on a good track to get going on what we need to do currently.

Mr. FRIEDMAN. Well, that's a great point, and that is part of the reason why it's not only about pushing better fuels, it's also about getting vehicles and more alternatives to vehicles out there. We're not going to solve global warming with a single silver bullet, with the wave of a magic wand. We need a portfolio of options and a portfolio of policies. Biofuels, I think, will be able to be a part of that, but we can't expect them to carry the whole load.

Senator LAUTENBERG. Yes, we're all hoping for a silver bullet.

[Laughter.]

Senator LAUTENBERG. I ask, with the indulgence of Senator Stevens, for one more question that—

Even with fuel efficiency improvements, airplanes, Mr. Meenan, will not be as efficient as trains, particularly for journeys of 400 miles or less, and particularly in highly populated areas. Doesn't it make sense, environmentally as well as economically, to invest more in rail? Shouldn't we be encouraging—and I ask this for any one of you who would like to respond—shouldn't we be encouraging the most efficient travel possible? And as it appears now, it's rail. Any comments on that?

Mr. MEENAN. Senator, I think—

Senator LAUTENBERG. Mr. Meenan?

Mr. MEENAN.—I think the second part of your question was the answer that I would give you, which is, we should be encouraging the most efficient—energy efficient transportation possible. In some markets, that may be rail. It may be, in a very high-density market, that may make perfect sense. But, in other markets, similar distances, you may not have that density, and air is a better energy-efficient alternative than 200 cars making that trip, for example.

So, we're open to all kinds of—we also believe, though, that public investment ought to also be directed at finding more efficient ways—energy-efficient ways of advancing air transportation, as well. And that's one of the reasons we're encouraging more investment in alternative fuel research for aviation.

Senator LAUTENBERG. Yes, but, also, a question that's often raised, as you well know, sir, is whether or not distances to travel have to figure into the best manner to transport people. And when you see—in Europe, for instance, if you want to go from Brussels, where we have our NATO headquarters, to other cities, like Paris, when you have an hour-and-20-minute ride for 200 miles, it's hard to find an airplane trip that you can take there. So, that has to be a consideration, as well as population density.

Mr. MEENAN. But, there are also differences in existing infrastructure in Europe that are not necessarily replicated in the

United States, so that we couldn't, for example, have all destinations within 400 miles of Washington, D.C., linked by rail, I don't believe, and do it efficiently, but we could do it in certain high-density corridors.

Senator LAUTENBERG. I'll take no longer. We will keep the record open for questions.

Senator Stevens?

Senator STEVENS. Thank you very much, Mr. Chairman. Been an interesting hearing.

You know—and, Mr. Friedman, I respect your comments, but I don't see anything that is dealing with the basic balance of cost against change, particularly in terms of some of these ethanol. Ethanol costs a great deal more, really, than oil or gas right now, and it's subsidized. We took away all the subsidies for oil and gas in the past, but we're applying them now to ethanol. The more ethanol, more subsidy. How do you get down to balancing the overall cost to the Nation of this change?

Mr. FRIEDMAN. Thank you, Senator, for the question.

First, I would say there are definitely still substantial incentives for petroleum fuels, whether they be tax credits or access to public lands—and, in fact—

Senator STEVENS. I hate to interrupt you, but there is no such thing as access to public lands right now for oil and gas exploration; it has just actually been static now for at least 10 years.

Mr. FRIEDMAN. But, I think, when we look at the cost of ethanol, this is one of the reasons why we do need the incentives, in order to get the prices down.

Senator STEVENS. Well, the incentives are adding to the cost to the public. It's just a question of whether you put it on the taxpayer or on the purchaser of the ethanol. Ethanol is so subsidized today, it's limited in expansion. Why rest on the ethanol alternative?

Mr. FRIEDMAN. Well, one of the great things that I think you point to is, actually, what we need to do is move away from simple tax credits for any one specific fuel, and, instead, move tax credits to performance basis. You should get a higher tax credit if you're a lower-carbon fuel. If we encourage performance, then the best solutions will emerge. Maybe it will, maybe it won't, be ethanol. Maybe it will be low-carbon electricity, maybe it will be hydrogen. But, if we encourage increased performance, maybe we can even get refineries to improve their efficiency so there's a little bit less global warming pollution associated with gasoline. Performance-based standards are the key.

So, I do agree that we need to move away from, maybe, specific products, and move toward performance, and especially global warming performance, when we look at our incentives.

Senator STEVENS. Mr. Hamberger, all you need to do is find me the money to build about 150 miles of railroad, and we could be connected to the Canadian rail system and have a lot cheaper transportation in the long run. You think you could find that kind of money, 150 miles, these days?

Mr. HAMBERGER. Well, I know that your former colleague, Senator Murkowski, believed very strongly in that, as well, and—I don't know where that planning process is. I believe the Canadian

and the U.S. governments were supposed to put together a commission to take a look at that.

Senator STEVENS. And we should, we really should. I think that the difficulty is the people don't realize the great efficiency of the rail system, particularly in places like we live, in Alaska. As Mr. Treadwell could tell you, that the advent, now, of thinking we're going to have trans-Arctic steam—or ship transportation is sort of hard to realize, it might come true. Barring that, Mr. Treadwell, how does it look, as far as getting the kind of agreements that would be necessary to use the Arctic for surface transportation?

Mr. TREADWELL. Well, as you know, the Senate is considering—excuse me. Thank you, Senator, for the question. As you know, the Senate is considering approval of, or accession to, the Law of the Sea Treaty. And the Law of the Sea Treaty, basically, deals with the territorial issues. Under the United Nations, we already have participation in the International Maritime Organization. The Coast Guard is doing bilateral discussions right now with the Russians about the Bering Strait, sometimes now referred as the Bering Gate. But, something to consider is the fact that we can probably agree fairly quickly on new rules for the Arctic, but the issue is new investment needed for the Arctic, as well, that we have coordinated investment in the St. Lawrence Seaway, for example, and that may be something the Nation wants to look at in the Arctic with other nations.

Senator STEVENS. Thank you very much for the hearing, Mr. Chairman. I really think that until Americans wake up to the fact that we're sending out our capital overseas to buy oil we could produce here at home, we're not going to see the capital formation that's necessary to make the changes that all of you agree seems to be necessary in our transportation system. I just don't see the ability to add the cost of this change on the taxpayers. It should come from increased revenue from activity in the United States of producing our own oil and gas.

Everyone talks about how much we'll save at the pump. They don't understand, the real savings comes from the job creation and the increased activity in this country that would come from producing our own supply of oil and gas.

Thank you, Mr. Chairman. Appreciate it.

Senator LAUTENBERG. Thank you.

Senator STEVENS. I do have some questions I'd like to submit for the record, but I have to go to another—

Senator LAUTENBERG. I agree. I would just take a moment to respond to my eloquent friend from Alaska and say that the full measure of the cost of getting more material from those sources is not simply the cost for the material—oil, in particular—but our costs for then protecting these states and their governments, and the cost is substantially higher. And I think that if we continue to want to compete there, then the costs for fuel is going to go substantially higher than it is now, and presents the question for us.

Senator Thune?

**STATEMENT OF HON. JOHN THUNE,
U.S. SENATOR FROM SOUTH DAKOTA**

Senator THUNE. Thank you, Mr. Chairman. And thank you for holding this—thank the Chair and the Vice Chair for holding the hearing on the impact of the transportation sector on climate change, and vice versa.

I think it's important that, whenever you talk about the topic of transportation's impact on carbon dioxide and other greenhouse gas emissions, to start with the energy bill of 2007. In addition to the historic increase in vehicle fuel efficiency standards and other energy efficiency programs, the bill also included an expanded Renewable Fuel Standard.

The 2007 energy bill requires the use of 36 billion gallons of renewable fuel by the year 2022, and it also includes significant requirements for life-cycle greenhouse gas emission reductions. In fact, under the bill, new corn ethanol plants must produce ethanol with a 20 percent reduction in life-cycle greenhouse gas emissions. And when you start talking about advanced biofuel and cellulosic ethanol, which constitutes the majority of the new Renewable Fuel Standard, those have to have a 50 percent reduction and 60 percent reduction in life-cycle greenhouse gas emissions relative to regular gasoline.

So, this was a landmark piece of legislation that I don't think can be overlooked. We need to start discussing the transportation sector's impact on greenhouse gas emissions. And moving forward, we've got to continue to meet the challenges of high fuel costs and greenhouse gas emissions with commonsense policies that reduce those emissions while, at the same time, helping U.S. businesses stay competitive, keep our economy growing and family budgets intact.

So, I wanted to make that general observation with regard to the RFS, but I guess I'd like to, more specifically, ask a couple of questions of the panel, and maybe get a reaction in terms of—and I'd direct this, I guess, to Mr. Meenan, to start with—but, if there was a policy that we could put in place, what's the single most important policy this Committee could pursue that would help with airline industry—the increase in fuel costs that you're dealing with, with fuel efficiency, trying to lower your fuel bills and decrease greenhouse gas emissions? That's something—we all see the spike in everything in the economy right now, but airline ticket fares are no exception—I know, driven by the high cost of fuel. Any thoughts about that?

Mr. MEENAN. Senator, without any question. The subject was addressed yesterday by Northwest's Chairman and CEO in his testimony up here. We believe that getting after some of the speculative pressure in the oil market would be the most direct and immediate means of driving some of that cost out of the price of a barrel, at this point. Experts in the field say that it could drive the price down as much as \$40–\$50 at a single sweep. Even assuming that that may be an exaggeration—even \$20, even \$5 would be a marked improvement from where we are today. We see no risk in getting after a little bit more regulation, a little bit more focus on what's going on in that market today. As you know, we're trading as many as 20 paper barrels of oil for every single barrel of actual

product that's used. That suggests to us that there's a lot of froth in the market that might be reduced by getting after the speculative pressures.

Senator THUNE. Does your organization—have they taken any kind of position on—specific piece of legislation or way of going about doing—I know a number of proposals that are swirling around out there.

Mr. MEENAN. Senator, we're working with a number of different members who are proposing a variety of different measures. And right now we're trying to, sort of, hone in on whatever the most effective vehicle will be, and go with that. But, it's—the debate is still swirling, at this point, but I—we're hopeful it's going to get resolved in the next few days, if at all possible.

Senator THUNE. Anybody else care to comment on that? I know I directed it to the aviation industry, but any, just, general thoughts about specific remedies that Congress could pursue that—policies that would help address—

Mr. HAMBERGER. To the availability and price of fuel?

Senator THUNE. Yes.

Mr. HAMBERGER. I don't know how my friend to the right will react to this, but are part of a coalition pushing coal-to-liquids, and believe that that would certainly provide both a domestic and a reliable source at a reasonable rate.

Senator THUNE. Yes, if—maybe, direct this to your friend to the right.

[Laughter.]

Senator THUNE. My left, your right.

But, with respect to the whole issue of the RFS and biofuels and everything else, how do you see the—sort of, the movement of the next-generation biofuel, cellulosic ethanol, as—with respect to how it will contribute to reducing CO₂ emissions and the broader issue, I suppose, of climate change, but the impact that that might have on our transportation infrastructure if we move more to biofuels?

Mr. FRIEDMAN. Thank you, Senator.

I expect that the potential is out there for the sustainable production of maybe 40–50 billion gallons of biofuels over the next 30, 40, 50 years, significantly less than some people are pointing to. But, one of the most important things we have to realize is that, as we tackle global warming pollution, as we tackle oil dependence, we need to make sure we're not creating any tradeoffs between the two. We need to focus our research, our incentives on the best of the biofuels, the cleanest of the biofuels. We also need to do the same when it comes to any fuel.

When it comes to coal-to-liquids, look, if coal-to-liquids can get a dramatic reduction in global warming pollution, the same as renewable electricity, then it belongs in the mix. Right now, all the data shows that making liquid coal can potentially double global warming pollution.

So—but, as long as we have a fuel policy based on performance standards and incentives based on greenhouse gas performance standards, I don't think we have to have these big debates over which fuel is the best, which fuel is the worst. As long as we guide the performance, the market is going to figure out which are the most cost-effective options out there.

We also have to remember that the Renewable Fuel Standard isn't enough. It really only covers about 10 percent of the market. That's why we need to move to something like a low-carbon fuel standard to broaden out what we're doing.

Senator THUNE. But, the RFS does have—

Senator LAUTENBERG. Senator, may I ask, how much more do you have? We are going to keep the record open for questions, if we could wrap it up.

[Laughter.]

Senator THUNE. Thank you for that not-so-subtle hint.

[Laughter.]

Senator LAUTENBERG. That's how I got to be Chairman.

[Laughter.]

Senator THUNE. Well, it'll get us both to lunch, I guess, but—

[Laughter.]

Senator THUNE. I will, I'll submit any other questions I have for the record.

Senator LAUTENBERG. If you have one more—

Senator THUNE. No, that's all right. I just wanted to ask—I guess, in—just as a quick follow-up on—

Would you all not concede, however, that the RFS, inasmuch as it is only—we say we use 140 billion gallons of fuel every year in this country—even if we get to 36 billion gallons, 21 billion of which will be cellulosic—that that is going to have a significant impact because of the requirements we imposed in the Renewable Fuel Standard on reduction of greenhouse gas emissions, life-cycle greenhouse gas emissions—that that's going to have a positive impact?

Mr. FRIEDMAN. Great question. And the portion of the Renewable Fuel Standard that does have greenhouse gas standards, I think, will have a clear and positive effect. One of the challenges, though, is that on the order of 13 to 14 billion gallons of corn ethanol remains completely unregulated when it comes to global warming pollution. It was grandfathered in as part of the Renewable Fuel Standard.

Honestly, if you look at the potential land-use impacts and increased global warming pollution from some of those fuels, we could end up with only a very small benefit from the Renewable Fuel Standard, as written. This is why, again, we need to eventually move beyond turning food into fuels, even just simply for climate reasons. And this Committee, I think, has a role to play in all of these things.

One of the other things I definitely want to urge this Committee to do is to exercise its oversight powers, as well, on the Department of Transportation to make sure that our upcoming fuel economy standards are as strong as they can be.

Senator THUNE. Thank you.

Thank you, Mr. Chairman. Thank the panel for your testimony. Appreciate it.

Senator LAUTENBERG. Thank you.

With that, we thank you again, to the witnesses, and we'll keep the record open.

We're adjourned.

[Whereupon, at 1:10 p.m., the hearing was adjourned.]

A P P E N D I X

PREPARED STATEMENT OF HON. BARBARA BOXER, U.S. SENATOR FROM CALIFORNIA

The transportation sector is a significant contributor to global warming.

Approximately 33 percent of greenhouse gas (GHG) emissions in the United States come from transportation. And 72 percent of the transportation sector's emissions are generated by road use.

The movement of goods has a real impact on air quality and global warming emissions. Freight transportation still largely relies on fossil fuels and consequently produces significant greenhouse gas emissions.

As a percentage of all mobile source emissions, heavy-duty truck, rail, and water transport together account for more than 25 percent of CO₂ emissions, approximately 50 percent of NO_x emissions, and nearly 40 percent of particulate (PM) emissions in the United States.

My home state of California has long suffered from air quality problems from transportation emissions. According to the California Air Resources Board (CARB), approximately 75 percent of diesel particulate emissions in California are related to goods movement.

In addition, CARB has attributed 2,400 premature deaths to diesel emissions and estimates that the health costs of diesel emissions could be as high as \$200 billion in 2020.

The movement of people and goods is vital to our economy, but it clogs our roads, fouls our air, pollutes our water, and creates safety issues.

For example, idling in traffic congestion is a tremendous source of carbon dioxide emissions and fuel. Billions of gallons of fuel are burned by vehicles stuck in traffic. This type of congestion stifles our economy and uses our energy resources and produces greenhouse gas emissions that are contributing to global warming.

Through the use of traffic signal timing and other technologies we can reduce idling, which can make a significant contribution to reducing GHG emissions.

In addition, we can help reduce congestion and the growth of highway demand by shifting trips to other modes of travel. Making more trips by biking, walking, carpooling, and reducing the number of trips necessary, by telecommuting, for example, could help reduce GHG emissions as well.

A combination of strategies including land use and increased public transit ridership could significantly reduce transportation-related CO₂ emissions.

By reducing congestion we can also improve the quality of the air we breathe and improve public health.

However, in addition to working to reduce GHG emissions to limit future warming, we also need to prepare our transportation system to withstand the unavoidable impacts of global warming.

Recent studies by the Transportation Research Board of the National Academy of Sciences and the U.S. Department of Transportation (DOT) underscore the need for adaptation planning at the state and local levels.

Six of the Nation's top ten freight gateways, which are centers for economic activity, will be at risk if sea levels rise.

60,000 miles of coastal highways already experience coastal storm flooding and wave action. This number is certain to increase with rising sea levels, leaving communities vulnerable to ocean waves and cutting off evacuation routes.

Climate change will have significant impacts on transportation, affecting the way U.S. transportation interests plan, design, construct, operate, and maintain infrastructure.

That's why I am pleased the Committee is holding this hearing to examine the impacts of climate change on the transportation sector.

I thank the Chairman for holding this important hearing. We are looking at these issues in the Environment and Public Works Committee as well. A cap and trade system to control carbon pollution could provide substantial revenue to address carbon emissions in the transportation sector.

I look forward to hearing from the witnesses before us today.

PREPARED STATEMENT OF CAPTAIN MARY ANN SCHAFER, CHAIRPERSON, AVIATION
SUSTAINABILITY AND ENVIRONMENT TASK FORCE, AIR LINE PILOTS ASSOCIATION,
INTERNATIONAL

On behalf of the 54,000 airline pilots represented by the Air Line Pilots Association, International (ALPA), I am pleased to offer this testimony to the Senate Commerce Committee. We appreciate the Committee's interest in climate change and the impacts on the transportation sector and are pleased to share our perspective.

It may not be apparent why ALPA would have an interest in this subject, so I will explain. ALPA's motto, since its beginning almost 77 years ago, has been "Schedule with Safety." A former FAA Administrator and others have dubbed ALPA the "conscience of the airline industry" and in that role, we take very seriously the need to ensure that any new operational measures are fully understood and thoroughly considered before implementation. Pilots literally sit at the intersection of new technology, operational measures, air traffic control procedures, and varying aircraft capabilities. This gives us a unique vantage point to see and experience first hand what well-intended, but unrealistic operational procedures can do to safety margins.¹

Another principal reason for our interest in this subject is the need to ensure the ongoing viability, what we call the sustainability, of our airline industry. We recognize all too well that our employers are under tremendous financial stress due to the record high cost of fuel and pressures from environmental concerns to reduce fuel consumption and corresponding emissions. Pilots have a genuine ability to help their airlines burn less fuel, and thereby put less noise and tailpipe emissions into the environment. Pilots look for opportunities to reduce fuel burn and do so every day.

Pilots and the airline industry as a whole have already made great strides toward reducing total fuel burn, noise, and tailpipe emissions. We believe Congress should take this into account when it considers any legislation regarding greenhouse gas (GHG) emissions. I will discuss later the extraordinary investments that our employers have made to reduce consumption and pollution.

With oil peaking near \$140 per barrel, airlines are parking airplanes because they can no longer afford to fly them, name-brand legacy carriers are looking for mergers in order to survive, airlines are spending about 40 percent of their revenues on fuel, and airline pilots are facing an uncertain future in an industry unstable because of this energy crisis. Already this year, four carriers have shut down entirely and more than 14,000 airline jobs have been eliminated.

Airlines and aviation face unique challenges. First are the long and expensive lead times for the research, development, design, and certification implementation for new technologies. Second is the lack of any economically viable alternative to fossil-based fuel. Compounding these issues is the lack of a comprehensive national energy policy that addresses the short and long term needs of our transportation systems.

ALPA's Work to Improve the Environment

As evidenced by the creation of our President's Task Force on Aviation Sustainability and Environment, ALPA takes environmental concerns very seriously. We are, and will continue to be, part of the solution as evidenced by the following activities:

- ALPA is participating in the work of Commercial Aviation Alternative Fuel Initiative (CAAIFI), which involves the airlines, aircraft manufacturers, and the scientific community collaborating to find new and better sources of fuel for aviation.
- We are also a member of the Advisory Board for the Partnership for Air Transportation Noise and Emissions Reduction (PARTNER) effort and the FAA's Joint Planning and Development Office (JPDO) Environmental Working Group.
- Our most recent success story: ALPA was a principal co-sponsor of a two-day conference for more than 200 government and industry participants in March, called *Aviation and the Environment: A Primer for North American Stakeholders*. The purpose of the forum was threefold:

¹ For example, a recently designed descent path into a major east coast airport required pilots to cross closely spaced points at successively lower altitudes. The points were too close together to allow pilots to meet the restrictions using advanced aircraft navigation computers resulting in increased pilot workload in a critical phase of flight. The procedure was revised based on pilot and controller feedback.

1. Put the environment debate into context and educate the members of the co-hosting associations on the basic facts.
2. Examine some of the policy options, measures and decisions proposed to curtail and reduce overall noise and emissions.
3. Provide a platform to communicate aviation's already impressive gains in the reduction of noise and emissions and highlight ongoing industry environmental initiatives.

Safety and Operations

Airline pilots can, and do, save fuel and emissions through operating techniques. Safety is our utmost concern, of course, but where safety is not impacted, airline pilots will reduce fuel usage through such measures as:

- Single-engine outbound taxi—Under certain conditions, it is not necessary that all aircraft engines be operated to taxi on the ramp or on taxiways. When conditions permit, only one engine may be started out of two or more available engines until reaching the end of the runway for takeoff.
- Engine shut-down during inbound taxi—Once the aircraft has exited the landing runway and is headed to the gate or parking stand, one or more operating engines may be shut down either in the taxiway environment or on the ramp.
- Technology enhanced departure procedures—New procedures are being developed with the aid of Area Navigation (RNAV) and Required Navigation Performance (RNP) technology which permit shortening the distance and time traveled during approach and departure.
- Optimal altitude—Each jet aircraft, based on weight and ambient conditions, has an optimum altitude where fuel burn is minimized. To the extent that conditions and circumstances permit, pilots may request that optimal altitude in order to conserve fuel, which reduces emissions.
- Optimal-speed flight plans—Planning and operating a flight at an efficient speed can save fuel. Pilots can optimize fuel burn based on aircraft weight, winds, and atmospheric conditions.
- Continuous Descent Arrival (CDA)/Optimized Descent Procedure (OPD)—Normal approach and landing procedures require an aircraft to reduce power, descend to a new altitude, and then add considerable power to level off and fly straight and level—that process may be repeated several times during any approach and landing. A new approach procedure, the CDA, or what we refer to as an OPD, is being developed that permits pilots to reduce power on all engines and not use significant thrust until safety concerns dictate establishing a stabilized approach configuration just before landing. This procedure cannot work at all airports at all times due to operational constraints, but at those locations where it can be used, it can save substantial fuel on a single approach.
- Reduced Vertical Separation Minimum (RVSM)—Taking advantage of improved technology, appropriately equipped aircraft can now fly with 1,000 feet—compared with 2,000 feet previously—vertical separation at higher altitudes. This operational change added six additional useable altitudes increasing the opportunity for pilots to fly their aircraft at the optimal, most fuel efficient altitude, in addition to permitting much greater airspace utilization.

Aviation's Envable Environmental Record

Aviation arguably has the most successful record of limiting its impact on the environment while increasing its productivity of any industrial sector. Airlines have greatly reduced carbon-based emissions through engine technology which reduces fuel burn and emission of undesirable gases and particulates. *Compared to aircraft in use in 1972, the U.S. airline industry now carries six (6) times more payload using 60 percent less fuel and has reduced by 95 percent the number of people significantly impacted by aircraft noise.*² This outstanding record of environmental achievement has resulted almost entirely from the airlines continually demanding new aircraft from the manufacturers that burn less fuel, carry greater payloads, and create less noise. Boeing is preparing for the first flight of the B-787; due to its cutting edge technology, that aircraft is designed to use 20 percent less fuel—and thereby create 20 percent less GHG emissions—than current aircraft of the same size. This aircraft is just one example of the kinds of investments that the airlines make in a very

²“Aviation and the Environment: A National Vision Statement, Framework for Goals and Recommended Actions,” Report to the U.S. Congress, December 2004; *see also*, “Aviation and the Environment: A Pilots' Perspective,” British Air Line Pilots Association, March 2007.

heavily capitalized industry; those investments should be taken into account by any legislation that deals with fuel conservation and GHG emissions.

Recommendations

As described, the airline industry has already made great progress toward reducing GHG emissions without the creation of a new commodity market that would funnel its assets to other industries and entities.³ That said, the industry does need your help to boost our great progress:

- Provide sufficient and timely funding to the FAA for necessary improvements in the U.S. National Aviation System (NAS). Funding the national airspace system modernization components needed to enhance aircraft efficiency, safety, and capacity will help in reducing delays, fuel consumption, and emissions. Implementation of the Next Generation Air Transportation System (NEXTGEN) could eliminate as much as 15 percent of today's delays, increase safety and capacity, and concurrently reduce emissions. Funding important studies like wake vortex investigations will also help. More information and understanding of wake vortex patterns around runways will allow spacing of traffic on the runway based on real hazards—a more accurate standard than the currently used mileage separation.
- Continue funding for important infrastructure improvements including runway and taxiway additions and improvements. Poor airport design, including those with intersecting runways, increases taxi time and increases fuel use. Adding high-speed taxiway exits from runways can reduce runway occupancy time thus increasing airport capacity. Additional runways, like those in progress at Seattle-Tacoma and Washington Dulles airports, reduce fuel wasted in holding patterns and long lines of aircraft waiting for take-off.
- Give greater support to research for alternative fuels which are renewable, pollute less or not at all, and are less expensive than today's fuels. Because of aircraft engine design and extreme atmospheric conditions at altitude, the airline industry relies entirely on petroleum-based fuels; it cannot currently substitute ethanol or other fuels as some industries are able to do.
- Avoid adding economic burdens, in the form of market-based measures, to an already crippled industry. Such measures as planned to take effect in Europe and proposed in the Lieberman-Warner bill are biased against the airline industry and do not provide sufficient re-investment of revenue for new aviation technologies and fuel. These carbon cap-and-trade schemes are designed to provide an economic incentive to reduce emissions—our industry already has that incentive and is continually searching for more ways to reduce fuel use and emissions. Diverting funds needed for new, more fuel efficient aircraft and alternative fuels research will only slow these efforts.
- Work with the International Civil Aviation Organization (ICAO) to establish emissions standards and operating measures for uniform application across this global industry.

Conclusion

Aviation is a good news story; we safely move hundreds of millions of passengers around the world in comfort, at great speed, and with less impact on the environment than any other mode of transportation in history. However, aviation is a visible target and has drawn the attention of numerous groups around the world who condemn the industry for being a driver of projected climate change.

As pilots, we deal with facts, and the facts clearly show that while aviation is a contributor of greenhouse gas and other emissions, it plays only a small role in the overall issue. Indeed, we could ground the entire world's fleet, and not have a significant effect on the climate change issue. The industry is poised to make great strides in reducing emissions through technology and operating procedures. We believe that the best way to achieve those results is the same way that we have made such great advances thus far, namely, through industry's investments in increasingly advanced technology.

Thank you again for the opportunity to testify today. We urge Congress' support of our ongoing and future efforts to reduce aviation's environmental impacts.

³The International Civil Aviation Organization held a 2-day conference June 18–19 in Montreal to discuss carbon markets and their application to aviation. These voluntary and mandatory markets are maturing around the world and stand ready to envelop the aviation industry in a commodities market for carbon that will divert needed financing from true fuel savings initiatives.

RAILWAY SUPPLY INSTITUTE, INC.
Washington, DC, June 30, 2008

Hon. DANIEL K. INOUE,
 Chairman,
 Senate Committee on Commerce, Science, and Transportation,
 Washington, DC.

RE: JUNE 24, 2008, FULL COMMITTEE HEARING ON "CLIMATE CHANGE IMPACTS ON
 THE TRANSPORTATION SECTOR"

Dear Mr. Chairman,

The Railway Supply Institute appreciates the opportunity to submit comments to the Committee for the record on the contributions of the transportation sector to address climate change, and the potential impacts of climate change on the Nation's transportation infrastructure.

Established in 1908, RSI is the international trade association of the rail and rail rapid transit supply industry. We have over 200 members who provide goods and services to our Nation's freight and passenger railroads as well as our rail transit systems. RSI estimates that the domestic railway supply industry approaches \$25 billion in annual revenues and employs 150,000 people.

Many Americans are still trying to understand what climate change is and what needs to be done to address it. What Americans do understand is the cost of oil and the penalties we all must pay for being overly dependent on foreign oil. The fact remains that the more we can reduce our dependence on fossil fuels the more likely we are to reduce greenhouse gas (GHG) emissions that impact climate change.

Transportation consumes 7 out of every 10 barrels of oil consumed in the United States. Highway transportation dominates both energy use and GHG emissions, accounting for 72 percent of transportation energy use and carbon emissions in the Nation. The United States transportation system is the largest in the world, is a major source of global GHG emissions, and is almost entirely responsible for our Nation's dependence on oil as the major source of energy. While the United States has only 4.5 percent of the world's population, it uses 25 percent of the world's oil. About 60 percent of U.S. oil is imported. Clearly this suggests that until we have alternative fuels that can be economically employed on a wider scale, we must depend more on encouraging the development of the most efficient modes of transportation. In turn, that will help us achieve a reduction in GHG emissions.

Rail transportation is efficient and we need to focus more attention on investing in rail as a way to fight GHG emissions, reduce vehicle miles travelled (VMT) and improve fuel efficiency. The transportation investments made now will impact future transportation, environmental and social investments so we need to start getting these decisions right. Robert Puentes of the Brookings Institution has suggested that "America's transportation policy is adrift with no clear goals, purpose, or ability to meet today's challenges". He suggests that policymakers are too focused on highways and transit and have ignored passenger and freight rail which may be part of the solution to addressing other key policy issues (such as dependence on foreign oil, congestion and climate change).

Increased passenger rail should be part of the transportation modal shift required to address the proliferation of greenhouse gas production, while maintaining mobility. Furthermore, a strong, national railroad infrastructure helps to achieve some of our Nation's critical policy objectives:

- reducing carbon emissions;
- reducing congestion on our highways;
- improving transportation safety;
- reducing airport congestion;
- efficiently utilize land for transportation purposes
- reducing dependence on foreign oil; and,
- enhancing our ability to move vast numbers of people in emergency evacuation situations (*e.g.*, 9/11 or Katrina).

The 1973 events in the Middle East, which the French refer to as the "oil shock" changed the way of life for many in that country. The price of oil quadrupled and French policymakers saw only one way out for France—energy independence. The thought of being dependent for energy on a volatile region of the world such as the Middle East disturbed many French people. In the 1970s, the French decided that they could no longer afford to have an economy so dependent on imported oil.

Now the U.S. is facing a 2008 "oil shock" and the answer is not to manipulate the cost of oil downward or drill for more oil offshore as some have suggested. No,

the answer is energy independence first through utilizing the most efficient modes of transportation and then through alternative energy sources.

While we may argue over the method employed by the French—higher oil taxes and a move to nuclear energy—there is no arguing over their strategy to stop depending on imported oil to fuel their economy.

Today, the French are energy independent and are among the world leaders in lowering GHG emissions. One of the ways they have achieved this is by investing in electric high speed rail corridors throughout the country. Meanwhile the U.S. struggles with its addiction to oil and stands by idly as others develop energy efficient and carbon friendly high speed rail systems.

We know that the high cost of fuel in Europe and Asia has promoted development of high speed rail and the results have demonstrated that once reliable and convenient rail passenger service is available it begins to impact mode-shifting away from the higher carbon producing modes, particularly as the cost of auto and air travel increase.

Cost alone is not the true measure of our transportation policy. There is a cost of carbon, a cost of congestion and a very high cost of having a transportation system that is overly dependent on foreign oil. Transportation policy must focus on a reduction in vehicle miles travelled (VMT), less dependence on foreign oil, lower greenhouse gas (GHG) emissions, alternative to short distance air travel, reduction in congestion and realistic alternatives to driving.

Finally, it is important to note that 2 years ago the Center for Clean Air Policy and the Center for Neighborhood Technology released a report on High Speed Rail and Greenhouse Gas Emissions in the U.S. This report used the 11 federally designated high speed rail corridors in the U.S. to estimate the annual GHG benefits if these high speed rail systems were developed as planned. The report concluded that high speed rail development in these corridors “will generate substantial GHG savings in all regions”. All the evidence on fuel efficiency and carbon emissions points to the need to begin implementing these corridors now. We know what needs to be done and we need to find the will to do it.

Thank you for the opportunity to present our views.

Sincerely,

THOMAS D. SIMPSON,
Executive Director—Washington.

PREPARED STATEMENT OF STEPHEN A. ALTERMAN, PRESIDENT,
CARGO AIRLINE ASSOCIATION

My name is Steve Alterman and I am President of the Cargo Airline Association (“the Association” or CAA), the organization representing the interests of the leading U.S. all-cargo air carriers before Congress, Federal administrative agencies and the various states and localities throughout the United States.¹ I also have the honor of being the current Chairman of the Environmental Subcommittee of the FAA’s Research, Engineering and Development Advisory Committee (REDAC). On behalf of our air carrier association members, I appreciate the opportunity to comment briefly on aviation’s place in the debate over global climate change.

Initially, it is important to note that the all-cargo airline industry, and indeed the aviation community generally, has a record of achievement that clearly demonstrates a commitment to environmental sensitivity. For example, comparing the year 2007 with the year 2000, U.S. commercial airlines consumed 3 percent *less* fuel in 2007, while at the same time transporting over 20 percent *more* passengers and cargo. Moreover, between the years 1978 and 2007, fuel efficiency has improved by 110 percent.² Therefore, the aviation sector of the economy has been able to stabilize its contribution to total greenhouse gas (GHG) emissions at approximately 2 percent of the total GHG emissions in the United States.³ While this record is enviable, it cannot and should not end the discussion of the future course of the climate change debate in the United States.

For their part, U.S. airlines are not simply resting on their past accomplishments. As noted in the statement submitted to the Committee by John Meenan, Executive

¹ U.S. air carrier members of the Cargo Airline Association are ABX Air, Air Transport International, Atlas Air, Capital Cargo, FedEx Express, Kalitta Air and UPS Airlines.

² Although not directly related to the global climate change debate, it is also significant that the industry’s commitment to noise abatement has resulted in over a 90 percent reduction in the population exposed to significant aircraft noise since 1978.

³ In contrast, electric utilities contribute over a third of the total GHGs and the “emissions” of cattle and other livestock contributes approximately 18 percent.

Vice President and Chief Operating Officer of the Air Transport Association (ATA) on June 24, 2008, ATA member airlines have already committed to an additional 30 percent system-wide fuel efficiency by the year 2025. The major cargo carriers are included in this commitment and Cargo Airline Association members have been in the forefront of developing and implementing new operational procedures and technologies that will increase efficiency and decrease fuel burn. These efforts will continue as the industry continually upgrades its aircraft fleet and works with the manufacturing sector on airframe and engine technology and with the Federal Government on a new generation of more environmentally sensitive aviation fuels.

At the same time, the industry alone cannot achieve the enhancements that will be necessary in the coming years—especially in the current chaotic airline environment.⁴ Rather, both the legislative and administrative branches of government must recognize both the past achievements and future challenges in fashioning a program to ensure that the airline community meets its environmental goals—goals based on sound environmental science balanced with the operational realities of the air transportation system. If there were any doubt that Congress is fully engaged in the issue of global climate change, that doubt should be erased in reviewing the recently-introduced Lieberman-Warner Climate Security Act (S. 3036).⁵ However, this proposed legislation would only exacerbate an already untenable position in the airline community. While not directly addressing the airline industry, the provisions of this bill would impose a substantial indirect fuel tax that would be paid to the oil companies and would not in any way address aviation environmental issues.⁶

What, then, should Congress do to address environmental issues in the aviation community? First, it should be recognized that FAA Reauthorization is, among other things, an environmental imperative. Quite apart from the ongoing debate over FAA funding, both the House (H.R. 2881) and the Senate (S. 1300) reauthorization bills contain a number of environmental initiatives that are necessary if the industry and government are to move forward to meet the environmental challenges of the coming years.⁷ The most far-reaching program is the proposal to establish a government/industry consortium to develop, mature and certify “continuous lower energy, emissions, and noise engine and airframe technology” (CLEEN), with the following specific goals to be accomplished by September 30, 2015:

- Development of certifiable aircraft technology that reduces greenhouse gas emissions by increasing fuel efficiency by 25 percent relative to 1997 subsonic jet aircraft technology.
- Development of certifiable engine technology that reduces landing and takeoff cycle nitrogen oxide emissions by 50 percent, without increasing other gaseous or particle emissions, over the International Civil Aviation Organization standard adopted in 2004.
- Development of certifiable aircraft technology that reduces noise levels by 10 decibels at each of the certification points relative to 1997 subsonic jet aircraft technology.
- Determination of the feasibility of the use of alternative fuels in aircraft systems, including successful demonstration and quantification of the benefits of such fuels.
- Determination of the extent to which new engine and aircraft technologies may be used to retrofit or re-engine aircraft to increase the integration of retrofitted and re-engined aircraft into the commercial fleet. *See, Section 602 of S. 1300.*

In addition, the proposed legislation establishes various environmentally-based pilot programs and permits airports to undertake studies and to apply for grants targeted to reducing adverse affects of aviation activity on the environment at their airports. Taken together, these initiatives would build on the progress already made in reducing the impact of aviation on the environment.

The reason for detailing these prospective provisions is to emphasize that there are ways that the government and industry can together address aviation environmental issues by recognizing past successes and building on them—without impos-

⁴With fuel prices hovering around the \$135 per barrel level, airlines have been forced to take drastic action to simply stay in business.

⁵It appears that this legislation will not move forward in this session of Congress, but it is likely that the same or similar legislation will be introduced early in 2009.

⁶The funds collected in this manner would simply reimburse the oil companies for the tax imposed on them and would not be funneled into aviation projects.

⁷These challenges include, not only managing aviation’s impact on global climate change, but also dealing with the continuing issues of aircraft noise and aircraft engine emissions that affect local air quality.

ing punitive taxes that would further cripple an already reeling industry. If it is impossible to enact a reauthorization package before the end of the current Congress, the Association urges the Senate to attempt to find another vehicle that would permit these important environmental provisions to move forward.

Similarly, the FAA must be “encouraged” to expedite its program to modernize the airspace system. While this modernization has its roots in safety, efficiency and capacity gains, it also has a major environmental component. When more direct routings and approaches are possible, the immediate result will be less fuel use and a concurrent reduction in all emissions. The Association is encouraged by the appointment of a new FAA Senior Vice President for NextGen and Operations Planning and anticipates that this move will lead to short-term gains that might otherwise be delayed. However, the modernization program in general is a difficult major paradigm shift in the way traffic is managed and the FAA, industry and Congress must work together to ensure its success.

Finally, a unique opportunity may present itself when looking at the interrelationship between FAA Reauthorization and the environmental challenge. In view of the current impasse over FAA financing, all parties to the debate should be looking for a compromise funding solution. One such possible compromise might have positive environmental consequences. If the current excise tax system for commercial aviation were eliminated and replaced by an expanded fuel tax, carriers would have the incentive to save fuel by accelerating fleet modernization and the environment would benefit in the form of significantly decreased emissions.⁸ In addition, as noted by the Department of Transportation Inspector General in a report dated March 3, 2008,⁹ “. . . we found that jet fuel consumption is a better proxy for system use of the NAS than the current aviation excise taxes . . .”¹⁰

In conclusion, we urge Congress to recognize the environmental record of the aviation industry when taking action in the sphere of global climate change. In addition, consideration should be given to finding a way to enact legislation that implements those portions of S. 1300 that have environmental consequences. In the interim, the members of the all-cargo air carrier industry will continue to explore ways to improve its environmental performance while ensuring that it can continue to service its shipper clients around the world.

Thank you for the opportunity to file these comments. If the Committee has any questions with respect to the positions advanced, please do not hesitate to contact me.

NATIONAL ASSOCIATION OF RAILROAD PASSENGERS
Washington, DC, June 24, 2008

Hon. DANIEL K. INOUE,
Chairman,
Senate Committee on Commerce, Science, and Transportation,
Washington, DC.

Dear Mr. Chairman:

The National Association of Railroad passengers appreciates your providing a forum to consider how the transportation sector can innovate and adapt to address increased demand in a manner which mitigates the negative impacts of global climate change. I ask that this letter be made part of the record in today's hearing.

Based on 2005 data reported last year by the Oak Ridge National Laboratory, Amtrak energy consumption per passenger-mile was 17 percent lower than by airlines and 21 percent lower than by automobiles. However, these numbers may understate the rail advantage because:

1. Amtrak ridership has increased since 2005 while its energy consumption has been reduced.
2. While airlines and auto owners are constantly investing in newer, more fuel-efficient units, Amtrak's youngest locomotives are 7 years old; the main fleet of road diesels was acquired between 1996 and 2001. The well-known Acela train

⁸The Association does not specifically endorse such a system of FAA funding but feels that it should be explored as a potential compromise as the reauthorization debate moves forward. No final position on this type of funding can be taken until more details are developed.

⁹Department of Transportation Inspector General Report CR-2008-028, “Use of the National Airspace System”, March 3, 2008.

¹⁰The Report goes on to conclude that fuel consumption is not a perfect measure of system use, but it clearly indicates that such a measure is clearly better than the existing system. Department of Transportation Inspector General Report CR-2008-028, p. 3.

sets, due to safety-related design changes, will remain over-powered until additional passenger cars can be added.

3. Oak Ridge numbers do not reflect the added environmental damage that results from high-altitude emissions; there apparently is not yet scholarly agreement on how to quantify this added impact.

4. Externalities:

(a) The ability of trains to stimulate pedestrian- and transit-friendly development in town centers such as at Washington Union Station and in many other Amtrak-served communities of all sizes.

(b) Good intermodal connections among trains and other forms of transportation make public transportation more attractive by more closely emulating the auto's flexibility. Of particular note this summer is the planned August opening of the St. Louis Gateway Station which will give St. Louis Amtrak and Greyhound passengers their first attractive, visible terminal, and connection to local buses and the highly successful light rail line (that serves both the airport and Illinois suburbs).

Amtrak is now in its sixth year of increasing ridership, one of many indications that Americans remain way ahead of policymakers in willingness to embrace energy-efficient travel. President Bush and many other leaders tend to focus on "technology" as the solution to our climate change and energy problems but to overlook the fact that the most feasible "technology" we have at our disposal is adequate development of train service, which our Association has been promoting since our founding in 1967.

As Americans across the Nation struggle with record fuel prices and rapidly congesting roadways, the choice to ride trains, to some extent, has become a forced one—at least where seats are still available for sale. Amtrak's nationwide ridership jumped 11 percent in the last 7 months—clear evidence that Americans are turning to intercity passenger trains in reaction to skyrocketing gas prices and turmoil in the airline industry.

Now, the Nation needs to address the consequences of funding priorities that continue to neglect rail-transport—relative both to rail-development needs, and to Federal spending on other modes of transport. When people read reports of your good work on S. 294 and the House's recent passage of H.R. 6003, they are tempted to think that spending priorities have changed and "real" passenger train development is just around the corner. Last week's action on Fiscal 2009 funding by the House appropriations subcommittee brought us back to reality. Tough budget limits and heavy demands by other programs limited the increase in passenger train spending to \$144 million—enough to cover the back pay recommended by Presidential Emergency Board 242 and increase the tiny U.S. DOT fund for matching state investments to \$60 million from the current \$30 million.

Options to augment appropriated funds for passenger trains include an allocation of revenues from any cap and trade bill that may eventually become law, as well as tax credit and tax exempt bonds which Congress has considered as a high speed rail funding source.

We, as a nation, have too long been building cities predicated largely upon the assumption that every citizen has an auto. Instead of planning communities which take into account the changes that come with economic and population growth, we have continually utilized instruments and methods to delay facing the consequences of this growth. This is reflected in the growing cost of transport. A new Brookings Institute report says transportation is now the second largest expense for most American households—consuming on average 20 cents out of every dollar. The Surface Transportation Policy Project previously documented that transport takes a bigger share of household income where public transport is less developed. Auto-oriented housing configurations, in large part, limit the short-term relief the transportation sector can provide.

Long-term costs benefit analysis of our options underscores the importance of today's decisions and how they will shape the landscape and potential of our future cities and networks. By expanding passenger train capacity, we can quickly allow more Americans to use trains to cut transportation costs, avoid traffic stress and air travel headaches, and minimize our oil dependence and negative impacts on climate change. Beyond that, we will lay the foundation for enabling a growing share of our population to enjoy the economic and quality-of-life benefits that come with pedestrian-friendly development.

Thank you for considering our views.
Sincerely,

ROSS B. CAPON,
NARP Executive Director.

cc: The Honorable Ted Stevens
Other Committee Members

NATIONAL BUSINESS AVIATION ASSOCIATION, INC.
Washington, DC, June 23, 2008

Hon. DANIEL K. INOUE,
Chairman,
Senate Committee on Commerce, Science, and Transportation,
Washington, DC.

Dear Chairman Inouye:

As the Senate Committee on Commerce, Science and Transportation considers climate change issues, I would like to take this opportunity to reaffirm general aviation's commitment to reducing aircraft emissions and protecting our environment. On behalf of our 8,000 members across the country, National Business Aviation Association (NBAA) acknowledges that when it comes to general aviation operations, environmental stewardship is an imperative. We continually work to develop reasonable and balanced policies that support the industry's twin objectives of promoting mobility while minimizing its environmental footprint.

Although the industry represents a tiny fraction of transportation emissions, general aviation has long led the way in promoting advances aimed at minimizing its environmental footprint. For example, 20 years ago, the industry developed winglets for general aviation aircraft, which optimize aircraft performance and flight range, and contribute to a more efficient fuel burn, thereby reducing emissions. This equipment is now in place on a large number of general aviation aircraft.

The industry continues to reduce engine emissions through new technologies, which means that today's aircraft engines are cleaner, quieter, and more fuel-efficient than ever. In fact, general aviation turbine engines today are an average of 30 percent more fuel efficient than those certified in 1976—and 50 percent more fuel efficient than those introduced in the 1960s.

Operational improvements supported by general aviation have also resulted in system efficiencies that help the environment. Over 3 years ago, NBAA members began equipping aircraft—at their own cost—with cockpit technology allowing for Reduced Vertical Separation Minimums, or RVSM, which effectively doubled the system's airspace capacity.

General aviation was also at the forefront of the development of automatic dependent surveillance-broadcast (ADS-B), the cornerstone for aviation system modernization and capacity expansion, because it allows for optimal efficiencies in routing, approaches and other uses of the aviation system.

In addition, NBAA members supported the development of precision approach procedures, which likewise produce efficiencies by enabling operators to custom-tailor flight paths, minimizing fuel burn and noise, while preserving operational safety.

Going forward, NBAA will continue to look for ways to further reduce our environmental footprint.

We also believe that an effective way to reduce emissions is to continue the work already done to implement a more efficient Next Generation, or "NextGen" aviation system based on satellite technology. The Government Accountability Office has cited FAA data showing that "the full implementation of NextGen could reduce greenhouse gas emissions from aircraft by up to 12 percent by 2025."

NBAA commends the Commerce Committee for its work to modernize our system and expedite the transition to NextGen. We support the recent Senate agreement on FAA funding and look forward to working with the Committee to complete work on FAA reauthorization and aviation system modernization this year, so that the potential for significantly reducing aircraft emissions can be fully realized.

Thank you for your consideration of our comments. Please do not hesitate to contact me if you have any questions or would like additional information.

Regards,

EDWARD M. BOLEN,
President and CEO.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. DANIEL K. INOUE TO
HON. JOHN PORCARI

Question 1. What do you believe is the appropriate role for state transportation decisionmakers and planners in combating climate change?

Answer. The next authorization of the highway/transit program provides an opportunity to begin incorporating climate change considerations into Federal transportation policy. The challenge in this authorization will be to institute effective policies for reducing greenhouse gas (GHG) emissions and adapting to the impacts of climate change, while minimizing Federal regulatory burdens and ensuring that the transportation system continues to deliver a high level of accessibility and safety for passengers and freight traffic.

There are many ways to reduce GHG emissions from the transportation sector. Some solutions, including development of cleaner vehicle propulsion technology and fuels and improving fuel economy will largely be in the hands of manufacturers. GHG emissions can also be lowered by reducing transportation demand, including that in vehicle miles traveled (VMT); improving system operations and driver behavior; and providing modal alternatives. State transportation decisionmakers and planners may opt to pursue these options, but may be limited in part by funding and authority for implementing these various strategies.

Major manufacturers are already working on the development of much more fuel-efficient vehicles, including conventional gas/electric hybrids, plug-in hybrids, hydrogen fuel cell vehicles, and electric-powered vehicles. These innovations have the potential to provide a giant leap in energy efficiency and to reduce GHG emissions, without sacrificing safety or mobility. These types of breakthroughs are vital not only for reducing GHG emissions in the U.S. but also for reducing GHG emissions around the world, including developing countries. States can incentivize the adoption of these new technologies in many ways, including for example through the provision of tax credits or matching funds, leading-by-example in state fleets, and through support for pilot projects such as new fueling infrastructure.

Beyond technological improvements, effecting a policy shift toward smart, green and sustainable growth requires transportation planners and land use planners to align interests to create new and redeveloped places that reduce dependence on driving. Mixed-use, interconnected and pedestrian-friendly neighborhoods providing access to homes, jobs, schools, and other destinations will help reduce trip-induced emissions.

Recent evidence shows that VMT growth trends may be tapering off: rather than growing at 2 percent or more annually, VMT has been increasing at a modest one-half of a percent since 2004. And as we have all witnessed, VMT in recent months has declined further in response to sharply higher gasoline prices and economic forces. The recent VMT trends suggest that VMT growth is abating on its own, thereby lessening the need for Federal VMT reduction mandates. However, as long as VMT from carbon-based fuels is contributing to GHG emissions, we must link transportation and land use decisionmaking to reduce our dependence on oil and encourage the kind of land development and transportation choices that result in more climate-friendly, energy efficient, lower cost options for Americans.

While better land-use planning can be an effective tool in reducing GHGs and the growth in VMT, most land use decisions tend to be under local government control and not the purview of the states. It is imperative however, that states not be left out of the critical pathways for decisionmaking, as regional, multi-jurisdictional and multi-state issues are important aspects of planning effective strategies to reduce GHGs. Recent focus on Metropolitan Planning Organizations to combat climate change would be improved by consideration of the appropriate state role during the process from planning to implementation. The challenge of addressing climate change should be done as part of the existing statewide and metropolitan transportation planning process. The planning process provides the appropriate venue for States and Metropolitan Planning Organizations (MPOs) to develop strategies for reducing GHG emissions from the transportation system, adapting the transportation system to the impacts of climate change, developing our land sustainably, and increasing the absorption of GHGs. And while funding is necessary for those responsible for the planning stage—which may be at any level of government, and if at the local level, can be enhanced by input from the state—the significant resources that are provided for the implementation of projects to combat climate change should be accorded primarily to states for prioritized investment reflecting the scope of needs across the state.

GHG emissions should be addressed through a new framework that takes into account the global nature of the challenge. This framework will likely require new Federal direction, rather than relying on existing conformity requirements under

the Clean Air Act, which are designed for pollutants that can be controlled on a local and regional basis. The air quality benefits of this process are difficult to discern, and compliance with the transportation conformity requirements has become increasingly complex and costly. The air has become cleaner in recent years, but much of the improvement has resulted from technology and increasingly effective EPA regulations requiring a transition to clean vehicle engines and fuels. Should a GHG conformity process be considered, it is important that states play a significant role in the development of this strategy, to ensure that GHG impacts are considered at a regional level and not at the level of individual projects.

Question 2. As users of climate information and services, what type of data is most important to you and how do you think the Federal Government can improve the climate information and services it provides?

Answer. Much more data and information is needed regarding climate change adaptation and the potential impacts from rising temperatures on the transportation system. The following information would be helpful to state Departments of Transportation:

- Notification of high temperature days and the likelihood of forest fires, to allow states to prepare for and conduct evacuations.
- Notification of changes in precipitation patterns and specific severe weather events. Flooding stresses the capacity of drainage systems, disrupts traffic management, and increases highway incidents and damages pavement structure.
- Information regarding sea level rise and impacts to coastal areas. This information will allow the states to minimize disruptions in connectivity and access to the transportation network and provide reliable transportation services.
- Information regarding storm activity, which can lead to service disruption and infrastructure damage. Advanced notification will assist the states to better prepare for and conduct evacuations.
- Information regarding average temperature increases, which may require changes in materials, maintenance and operations.

Additionally, prior to requiring states to measure GHG emissions, EPA and FHWA must work with the states and MPOs to develop functional GHG emissions models. Models are necessary to determine the overall statewide emissions and the emissions benefits of selected emission reduction strategies.

Much more data will be needed to better understand and address transportation related emissions and mitigation strategies, particularly freight-related GHG emissions. Federal funding assistance will be needed to test, implement and evaluate a variety of solutions to address climate change.

States are at various stages of tackling climate change and new data needs are emerging daily. States will need assistance in identifying effective strategies for their particular region and circumstances. AASHTO is establishing a Climate Change Program that will assist in identifying additional data needs and will work with the Committees of jurisdiction in Congress as well as with EPA and U.S. DOT to tackle these important issues.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. THOMAS R. CARPER TO
HON. JOHN PORCARI

Question 1. We have had hearings in both this committee and in Environment and Public Works on freight movement. And most witnesses have called for a freight fund and single freight policy. This is because freight is moved by multiple modes of transportation on each trip—truck, train and ship. The system works better when we plan for the movement of the cargo as opposed to the machines moving them. It occurs to me that people are the same way. For example, I drive to the train station, take the train to DC and then walk to the office. What can we do during the transportation reauthorization to shift our policy toward moving people and goods instead of moving cars, trucks, ships, etc.?

Answer. AASHTO's authorization recommendations include an approach to reforming the planning and project selection process which addresses precisely this question. AASHTO's proposal closely parallels ideas recommended by the National Surface Transportation Policy and Revenue Study Commission. We recommend a five-step process: First, Refocus highway and transit programs, for the most part, on objectives of genuine national interest. Second, Set national goals through which the objectives can be achieved. Third, Direct states and MPOs through their long-range plans to set targets through which they will seek to meet the national goals. Fourth, Select investments which will help to achieve those targets. Fifth, Measure

improvements in performance which show the progress being made toward achieving those targets and report on the results. It is during the project selection phase when state DOTs and MPOs would determine which projects or mix of projects would best help meet the goals and targets in question. At that point, they would have to get specific and determine which improvement in which mode would be the best solution to the problem.

One key way to ensure effective decisionmaking and investment at the state level is to provide sufficient flexibility to states to shift resources between programs and modes. Flexibility across the programs and modes combined with performance measures will greatly improve the mode-neutrality of planning and implementation and improve the outcome of Federal investment for a better transportation system.

Question 2. Transit agencies across the country are struggling to meet increasing demand resulting from high gas prices. At the same time, more people are turning to transit as a clean, affordable way to travel. In fact, the typical public transportation user on average needs to buy half as much gasoline as a person without access to transit. Is the Federal investment in public transportation adequate to serve the public in an era of high gas prices?

Answer. From our perspective in Maryland, the answer is no—Federal investment is not adequate to serve our bus and rail transit needs. Our local communities and large municipalities are struggling to meet the needs of rapidly growing bus demands, and the Federal New Starts program is underfunded and ill-constructed to help communities tackle other transit needs.

AASHTO's transit authorization proposal calls for progressively increasing funding for transit over the six-year authorization period, totaling \$93 billion over the six-year period. In addition, the proposal calls for establishing transit-supportive policies to enable a doubling of ridership to more than 20 billion by 2030 and 50 billion by 2050.

In Maryland, our climate change commission report calls for doubling transit ridership by 2020 but we will need significant support from the Federal Government to do this and urge Congress to consider supporting at least the level of funding proposed by AASHTO. The economic downturn and higher gas prices are impacting the ability of many states to increase transit options. Obviously Maryland, compared to less-urbanized states, can and will rely more heavily on transit to solve our transportation issues, however, AASHTO's call for increased transit investment is a clear sign that transit is seen as part of the solution for states across the Nation.

Question 3. Several studies have shown that transportation plans are far more efficient and more effective at reducing greenhouse gas emissions when they are integrated with local land use and development plans. What role should the Federal Government play in helping ensure that its transportation investments are paired with good local land-use decisions to ensure that maximum the taxpayers' investment and to reduce emissions? What are state governments doing to address this?

Answer. The statewide and metropolitan planning process requires consideration of ways to "promote consistency between transportation improvements and State and local planned growth and economic development patterns." By maintaining this provision, Congress should continue to encourage strong linkages between transportation and land use plans.

States are increasing their efforts to link transportation and land use planning, while respecting local government's traditional role in making land use decisions. In States that are seeing increased growth, the current relationship has caused tensions. This said, many local governments are beginning to adapt their land use plans to encourage more energy-efficient land use patterns. AASHTO's authorization policies ask Congress to support these State and local efforts by increasing funding for joint initiatives to coordinate transportation and land use planning, including creation of a new Transportation and Land Use Program to replace the existing Transportation Community and System Preservation (TSCP) Program. Under this proposal, the former TCSP program would be transformed into a merit-based, competitively awarded discretionary program funded at \$100 million per year, with increased funding and emphasis on sustainability and quality of life. Funds would be allocated through a competitive application process by USDOT to States, MPOs, or local governments for:

- Programs and projects that support focused growth, infill housing, and transit-oriented development.
- The integration of context sensitive solutions.
- Programs that support local planning and policy programs and local technical assistance to better link transportation and land use strategies to preserve fragile natural and human environments.

- Programs and projects that improve connectivity within and between modes for passenger and freight traffic and use operations and management strategies to improve efficiency of the transportation system, avoiding the need for capacity increases.
- Programs and projects to ensure efficient access to jobs, services, and centers of trade.
- Transportation programs to reduce GHG emissions and increase GHG absorption.

AASHTO's authorization proposals also call for Congress to increase the Federal share for transportation projects explicitly designed to support sustainable land use and focused growth strategies and to reduce the rate of growth of VMT. Finally, AASHTO is calling on Congress to provide funding for transportation from climate change legislation to help address GHG reduction. A strong state role will help improve the viability of the investment decisions.

Question 4. Right now, the Department of Transportation is divided into agencies responsible for a single mode of travel. Further, when I was Governor of Delaware, I found that if we decided to build a road, we could get 80 percent of the funding from the Federal Government. If we chose to invest in transit, we might only receive 50 percent. However, if we decided the best, lowest cost investment was in passenger rail, we got no Federal funds at all. How does this impact the goal of intermodalism? And how might it interfere with the development of an integrated, efficient transportation system?

Answer. As the Secretary of a multimodal agency, I agree that the current system is flawed and needs to be revised. Inadequate investments have resulted in gaps in our transportation system, lowering transit or rail ridership, increasing aviation and highway congestion, raising VMT and GHGs, and lowering system effectiveness for all users. Investment in multi-modal projects and intermodal connectors should be enabled through changes in flexibility, funding levels, the provision of contract authority, and through a more equitable and simplified Federal approval process.

AASHTO's authorization policies call for the Federal share of transit projects (including New Starts) to be a minimum of 80 percent and for the establishment of a dedicated account for intercity passenger rail funded at an 80 percent Federal share for capital improvement projects. This Federal allocation requirement would aid in the selection of intermodal infrastructure investments and help move us closer to a seamless transportation system.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. DANIEL K. INOUE TO
HON. THOMAS J. BARRETT

Question 1. The Federal Government has ceded most of the decisionmaking about what types of transportation assets are built and used by most Americans to the states, localities, and private sector. While this decentralized control of planning has certain benefits, it also presents challenges to ensuring that nationwide goals are achieved in a uniform fashion, particularly in the face of a rapidly developing crisis like climate change. Do you believe that we must reassert a strong Federal role in planning and shaping transportation infrastructure and usage to ensure that nationwide goals are achieved, such as reducing fuel consumption and emissions?

Answer. We need to proceed carefully in addressing the challenges of greenhouse gas emission reductions and fuel economy in the transportation sector while maintaining the mobility and connectivity that is critical to national economic growth. Finding a balance between these goals, through fuel economy standards and in other ways, is best achieved through uniform national standards rather than a patchwork of different requirements across the states. We continue to believe, however, that regional transportation investment decisions themselves are best made by State and local governments because they know the transportation problems in their areas and can work with us to tailor the best options to address those problems.

Question 2. Did the National Highway Traffic Safety Administration (NHTSA) base the new fuel economy standards in its notice of proposed rulemaking on the average fuel economy standards for passenger cars and light trucks for model years 2011–2015 on the assumption that gas prices would be only \$2.31 per gallon in 2015? If so, can you explain to the Committee the foundation of this extrapolation? What is the relationship between this number and the fuel economy standards that the NHTSA will ultimately issue?

Answer. In its notice of proposed rulemaking, the agency used the reference case in the most up-to-date Department of Energy/Energy Information Administration's (EIA) gasoline price projections then available. The retail fuel price forecasts pre-

sented in EIA's Annual Energy Outlook 2008 span the period from 2008 through 2030. Measured in constant 2006 dollars, the reference case forecast of retail gasoline prices during calendar year 2015 is \$2.32 per gallon, \$2.42 per gallon during 2020, rising gradually to \$2.51 by the year 2030 (these values include Federal, State, and local taxes).

Gasoline prices, along with other economic and engineering assumptions, can affect the stringency of the standards. NHTSA sought comments on its assumptions for gasoline prices. The comment period closed on July 1, 2008. NHTSA is currently evaluating the comments it received. These comments will be considered in determining the final assumptions and the final standards.

Question 3. What is the methodology that the NHTSA uses to classify cross-over vehicles as either passenger cars or light trucks in the NHTSA's Notice of Proposed Rulemaking?

Answer. The NPRM followed NHTSA's regulatory definitions for classifying vehicles as passenger cars or light trucks. The definitions are contained in 49 CFR Part 523. Essentially, a vehicle may be classified as a light truck for one of two reasons: either because (1) it has off-highway capability, or (2) it has some functional characteristic that makes them "truck-like." If a vehicle does not meet the definition of "light truck," it is classified as a passenger car.

A vehicle is off-highway capable, and therefore a light truck, per §523.5(b), if it is either 4WD or over 6,000 lbs GVWR and meets 4 out of 5 ground clearance characteristics, like approach angle, departure angle, running clearance, etc.

Alternatively, a vehicle may be classified as a light truck if it is designed to perform at least one of the following functions, as laid out in §523.5(a):

- It transports more than 10 persons;
- It provides temporary living quarters;
- It transports property on an open bed;
- It provides greater cargo-carrying than passenger-carrying volume; or
- It permits expanded use of the automobile for cargo-carrying purposes or other nonpassenger-carrying purposes by removing or stowing the back seats to create a flat surface. (Starting in MY 2008, vehicles may qualify as light trucks under this criterion if they have 3 rows that fold or stow to create a flat surface.)

NHTSA sought comment on its classification system in the NPRM and is currently deliberating on this issue in developing the final rule.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. MARIA CANTWELL TO
HON. THOMAS J. BARRETT

Question 1. There has been significant Federal research undertaken on technologies to reduce the emissions of trucks that move freight. Can you tell me what parallel efforts have been made by your agency regarding freight rail?

Answer. The Federal Railroad Administration and the rail industry are pursuing several research programs focused on locomotive emissions reduction. For example, FRA has provided grants to Norfolk Southern Railroad and its partners, General Electric and New York Air Brake for the LEADER (Locomotive Engineer Assist/Display Event Recorder) project. The LEADER project is a tool for assisting locomotive engineers to operate trains more efficiently by maximizing the use of braking and power. The project has been successful in providing fuel savings (and therefore reducing emissions) of 15 percent.

In addition to the LEADER project, FRA has developed an in-situ emissions measurement system. This device is a portable emissions measurement system that will allow easy and frequent emissions measurement. Currently it measures some criteria pollutants (such as NO_x), but it does not measure particulate matter (PM). Future research will focus on PM measurement. Emissions measurement at regular intervals can promote engine efficiency, thereby reducing NO_x and other pollutants.

New research promises exciting future opportunities in emission reductions. The U.S. Army has sponsored a locomotive development program for a fuel cell locomotive, which has the potential for greatly reduced emissions. Locomotive manufacturers are also working to develop a road hybrid locomotive which captures the energy dissipated in dynamic braking.

The rail industry is pursuing a number of initiatives. One of the more successful areas are so-called Genset locomotives that use three smaller (700 HP) size truck-type diesel engines, which can be automatically turned off when the tractive effort demand is less than the peak demand. These "switcher" locomotives save 50 to 60 percent in fuel consumption, thus substantially reducing overall emissions. Bur-

lington Northern (BN) and Union Pacific (UP) already use switchers in California and Texas. The Genset concept is being extended to road locomotives with four 700 HP diesel engines for the equivalent of a 3000 HP locomotive. The industry has also adopted Auto Stop/Start systems (which allow locomotives to be shut down to reduce idling and the related emissions) and Auxiliary Power Units (APU) are also being used by the industry to provide air and heat instead of idling locomotives for these needs.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. THOMAS R. CARPER TO
HON. THOMAS J. BARRETT

Question 1. The transportation sector is responsible for about $\frac{1}{3}$ of our greenhouse gas emissions, making it among the largest emissions sources in our economy. How should U.S. surface transportation policy be updated to support the goals of climate change legislations? Should the transportation sector be responsible for $\frac{1}{3}$ of the emissions reductions necessary to meet targets science says is necessary?

Answer. In 2007, the transportation sector accounted for 28 percent of total greenhouse gas emissions and 34 percent of carbon dioxide emissions (2007). The CO₂ emissions of the combined commercial and residential electric power sectors, however, accounted for 39 percent of CO₂ emissions, making electric power generation the largest source of CO₂ in our economy. Greenhouse gas mitigation strategies vary in their cost-effectiveness, and generally stationary source measures have been found to be more cost-effective than transportation mitigation strategies.

As we develop strategies for reducing greenhouse gas emissions, we must be mindful of the indispensable role that transportation plays in sustaining and improving our economy, facilitating our trade, and ensuring the Nation's mobility and connectivity. Our approach for reducing emissions focuses on: improving vehicle efficiency; increasing the use of alternative fuels; advancing the efficiency of the transportation system (often by promoting market-based measures, such as congestion pricing); and improving our understanding of the impacts of climate change on transportation infrastructure. Additionally, while mandates and regulations have their place, new technologies and private sector innovations should be at the center of our national effort to curb emissions. We must address climate change in a way that does not compromise the competitiveness of our transportation providers or the shippers and passengers that rely upon them.

Question 2. Airport congestion is a major problem. We've seen many airlines shift toward flights consisting of many short hops rather than longer direct flights. Couldn't much of this short-hop air travel be shifted onto passenger rail if we put the resources into developing a network of convenient, high-speed service? Would that help relieve pressure on our airports? What would be the impact on greenhouse gas emissions?

Answer. As part of its environmental review of proposed airport enhancement projects, the Federal Aviation Administration (FAA) examines whether other modes of transportation or other congestion management actions might be appropriate alternatives or satisfy part of the demand for air travel as part of environmental review of proposed capacity enhancement projects. Passenger rail travel may be competitive for some trips greater than 150 miles in markets with frequent rail service such as through the Northeast Corridor, or mid-range trips between 250 and 500 miles where connections are direct and efficient. Travelers consider time, cost, and frequency of service in making choices about how they travel. In addition, the experience of the European Union, which has $\frac{1}{3}$ the land area and a more highly urbanized population than the United States shows that passenger rail services require enormous subsidies.

Current tools for estimating greenhouse gas emissions from different modes of transportation are limited, except for aviation. The FAA has developed the System for Assessing Aviation's Global Emissions (SAGE) model. SAGE is recognized as one of the premier models in the world for analyzing aviation greenhouse gas emissions and has been used by the United Nation's International Civil Aviation Organization and the Intergovernmental Panel on Climate Change. DOT's Center for Climate Change and Environmental Forecasting has funded some work on tools to compare emissions across modes, and FAA is doing extensive research on identifying emissions from aviation.

Question 3. Right now, the Department of Transportation is divided into agencies responsible for a single mode of travel. Further, when I was Governor of Delaware, I found that if we decided to build a road, we could get 80 percent of the funding from the Federal Government. If we chose to invest in transit, we might only receive 50 percent. However, if we decided the best, lowest cost investment was in pas-

senger rail, we got no Federal funds at all. How does this impact the goal of intermodalism? And how might it interfere with the development of an integrated, efficient transportation system?

Answer. Federal surface transportation programs have increasingly emphasized flexibility for States and local areas to choose transportation solutions that best meet their needs. This flexibility, however, has been limited by spreading Federal transportation funds over more than 100 programs and the proliferation of project-specific Federal earmarks. The Administration's new plan to refocus, reform and renew the national approach to highway and transit systems in America—announced on July 29—would consolidate Federal programs into a manageable few, and give grantees the authority to make worthwhile infrastructure investments, regardless of whether those investments involve transit or highway projects. The proposal also increases the way communities can fund projects with innovative financing mechanisms, such as private activity bonds, State infrastructure banks, and Federal credit flexibility.

Question 4. We have had hearings in both this Committee and in Environment and Public Works on freight movement. And most witnesses have called for a freight fund and single freight policy. This is because freight is moved by multiple modes of transportation on each trip—truck, train and ship. The system works better when we plan for the movement of the cargo as opposed to the machines moving them. It occurs to me that people are the same way. For example, I drive to the train station, take the train to DC and then walk to the office. What can we do during the transportation reauthorization to shift our policy toward moving people and goods instead of moving cars, trucks, ships, etc.?

Answer. Building intermodal connections that provide real value to system users should be a central national goal, but the constraints on cross-modal funding in current law frustrate that objective. We address this problem directly in our recently announced reform proposal.

For instance, the proposed metro mobility program is applicable to areas with populations greater than 500,000, areas that collectively generate 42 percent of the Nation's annual vehicle-miles traveled. This program enables performance-based transportation funding to supplant program and modal specific funding constraints. Funding is awarded through a competitive process, allowing multimodal flexibility in selecting projects for the movement of people and goods. Program projects must be Title 23 or Title 49 eligible, both of which include the flexibility to advance intermodal projects.

Further, the proposed metro mobility and Federal interest highway programs target Federal funds on elements of the system that are in the national interest. This focus of Federal funds on areas of national interest enables State and local governments to direct their own funds to projects that meet State and local mobility priorities, regardless of mode. By allowing more local control of transportation funding, decisionmakers most familiar with the movement of people and goods in a particular area can develop intermodal projects that provide the greatest benefits and the greatest return on the Federal dollar.

In regard to providing effective transportation access to America's treasures, such as our national parks, forests, and refuges, the Administration proposes combining the existing Federal Lands Highway Program with Transit in the Parks and Tribal Transit Programs to promote integrated transportation solutions where congestion is becoming a problem.

Finally the Department's reform proposal also increases flexibility that stakeholders have to tap into existing financing mechanisms. Removing the national volume cap of private activity bonds (PABs) would allow greater private sector, tax-exempt investment in highway and freight transfer facilities. Enhanced flexibility for State infrastructure banks (SIBs) would allow States to capitalize SIB accounts to provide loans or other forms of credit to public and private entities for eligible highway, transit, and rail projects. And reform of the Transportation Infrastructure Finance and Innovation Act (TIFIA) would broaden the availability and enhance the attractiveness of TIFIA credit assistance, allowing flexibility to structure credit support for vital, non-mode specific infrastructure projects, including intercity bus and passenger rail.

Question 5. Transit agencies across the country are struggling to meet increasing demand resulting from high gas prices. At the same time, more people are turning to transit as a clean, affordable way to travel. In fact, the typical public transportation user on average needs to buy half as much gasoline as a person without access to transit. Is the Federal investment in public transportation adequate to serve the public in an era of high gas prices?

Answer. The Federal investment in public transportation has increased significantly over the last few years. Annual Federal funding for public transportation increased from \$7.6 billion in 2005 to \$9.5 billion in 2008. The Administration's FY 2009 Budget proposes a total of \$10.14 billion in Federal spending on public transportation, an increase of \$644 million over 2008. This is a record level of funding and will help provide more transit service to accommodate increased demand.

High gas prices increase both ridership on public transportation and the cost of operating public transportation. Due to high gas prices, public transportation ridership increased 2.4 percent for the 12 month period ending in May 2008, over the previous 12 month period. The increase in ridership has helped cover the incremental costs associated with increased capacity utilization.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. DANIEL K. INOUE TO
DR. JAMES M. TURNER

Question 1. The recent National Research Council report on the impacts of climate change on U.S. transportation recommended that scientists develop and implement monitoring technologies that could provide advanced warning of pending infrastructure failures due to weather and climate extremes on transportation facilities. Can you describe how NIST will respond to this recommendation?

Answer. The National Institute of Standards and Technology (NIST) is directly addressing the recommendation of the recent National Research Council report that scientists develop and implement monitoring technologies that could provide advanced warning of pending infrastructure failures due to weather and climate extremes on transportation facilities. NIST is currently running a competition for proposals focused on developing solutions to the challenges of inspecting and monitoring civil infrastructures. The competition, "Advanced Sensing Technologies for the Infrastructure: Roads, Highways, Bridges and Water Systems", is aimed at enabling the development of sensing systems for the effective measurement of characteristics such as fatigue, corrosion, stress, usage, and damage in these infrastructures. The sensing systems and measurements will provide critical information for infrastructure decision-makers as they reevaluate design standards in light of new climate extremes.

NIST also has ongoing research programs on predicting the response of structures simultaneously exposed to multiple climatic hazards (*e.g.*, high winds and storm surge), real-time infrastructural performance monitoring to provide advanced warning of pending transportation infrastructure failures due to weather and climate extremes, as well as the materials research aimed at improving the resilience and durability performance of infrastructural materials. The President's 2009 budget includes an initiative to look at Disaster Resilient Structures and Communities. This initiative will enable the development of a robust capability to predict the effects of hazards on the performance of complex infrastructural systems, such as roads, highways, and bridges, and is ideally suited to address the types of infrastructure failures that are predicted to accompany climate change.

Question 2. What do you see as the greatest gap or deficiency in scientific research and information that NIST can address relating to climate change and transportation issues?

Answer. NIST has identified as a gap the need for developing sensing systems and measurements to provide critical information for transportation infrastructure decision-makers as they reevaluate design standards in climate extremes.

NIST also fulfills the need to develop the measurement science that rigorously monitors the impacts of the U.S. transportation infrastructure on climate change. A few of the activities in this area that NIST is currently addressing are:

- The composition, volume, and weight standards for fuels and oil to allow confidence in trading in low to high sulfur content fuels in competitive markets. This covers everything from measures and standards for fossil fuels and biofuels, and from train cars of coal to gallons of gasoline at the pump.
- Air Quality standards for sulfur dioxide and nitrogen dioxide that enable automotive manufacturers to meet Environmental Protection Agency (EPA) standards and generally allow industry to tune and trade their emissions through the EPA sulfur dioxide cap and trade system.
- Composition of refrigerants in automotive air conditioning systems to eliminate chlorofluorocarbons and find replacements that minimize impacts on air quality and ozone in the upper atmosphere.

- Production of roadway materials, and the composition, strength, and durability of road and bridge materials and construction techniques to minimize GHG emissions.
- Lightweight metal forming and composites to enable manufacturers to have high performance, high durability and safe materials to increase efficiency in the automotive and aerospace industry.
- Development of the measurement science and standards infrastructure to support the development and implementation of advanced alternative fuel sources such as hydrogen or biofuels.
- Developing Smart Grid standards for plug-in hybrid electrical vehicles scheduled to be in showrooms in 2010.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. DANIEL K. INOUE TO
THOMAS C. PETERSON

Question 1. In your opinion, what challenges do climate scientists face when attempting to produce and deliver climate information and services that are useful to transportation planners?

Answer. There are two main challenges that we face. The first is understanding the exact needs of transportation planners. This means knowing what weather and climate conditions impact transportation and exactly what types of information and data about these weather and climate conditions transportation planners require. The second challenge flows directly from the first, namely, developing the climate information at the temporal and spatial scale transportation planners need. For example, a person planning an upgrade to a railroad track needs to know the temperature and precipitation extremes that the track is likely to experience not for the track as a whole but at critical locations along the track because the temperature extremes and precipitation level may affect the performance of the facility.

Question 2. How is NOAA trying to address these challenges?

Answer. To better understand user needs, NOAA actively engages with the transportation community. For example, in 2007, NOAA hosted a specialized Data Users workshop to identify the requirements of the energy, insurance, and transportation sectors, with respect to data and information needs in the context of a changing climate. Also in 2007, the Office of the Federal Coordinator for Meteorology convened the Third National Surface Transportation Weather Symposium. These meetings brought weather and climate information providers together with transportation planners to, among other things, enhance understanding of the weather and climate information needed for transportation decision support. Furthermore, NOAA personnel serve on the Committee on Climate Change and U.S. Transportation initiated by the Transportation Research Board.

NOAA is working to expand weather services to encompass customer-focused climate services as well as to help fulfill NOAA's strategic goal of supporting the Nation's commerce with information for safe, efficient and environmentally sound transportation. This takes on many forms. For example, NOAA has developed the Pacific Region Integrated Climatology Information Products and the Pacific Regional Integrated Science and Assessment (Pacific RISA), as well as RISAs in other parts of the country, to provide the climate information needed in the Pacific to manage risks and support practical decision-making in the context of climate variability and change. NOAA is working with the Federal Highway Administration to update atlases of maximum 100-year 60-minute precipitation estimates on a fine enough scale to improve design flow estimates for improved design of highways. The challenges of producing accurate climate model output at spatial and temporal scales fine enough for transportation planners are great and this is a research effort currently underway at NOAA and elsewhere. While the ultimate payoff on the promise of this work is still unrealized, NOAA is providing up to date output of this research which is growing increasingly useful to decision support. NOAA is providing climate model output that has been reprocessed to scales that are fine enough to provide the location specific information that transportation planners need. As hurricanes anywhere in the world impact shipping, NOAA is leading the creation of an International Best Track Archive for Climate Stewardship tropical cyclone database so planners can see exactly where hurricanes have been in the past. NOAA is providing the basic weather and climate data and information from the U.S. and around the world that transportation planners need to respond real time to weather and design transportation infrastructure to operate smoothly for climatic conditions anticipated over its lifetime.

Question 3. Recently the U.S. Climate Change Science Program released its first assessment of weather and climate extremes in North America. Could you explain the significance of climate extremes, how such extremes may change in the future, and the expected impacts that these changes will have on transportation infrastructure and planning?

Answer. As described in our paper on the implications of climate change on transportation,¹ transportation is sensitive to changes in extremes. The release of the U.S. Climate Change Science Program (CCSP) report on weather and climate extremes in North America² is quite relevant to transportation planning. Below is a table combining key information from the CCSP report on extremes and the National Research Council (NRC) report on impacts of climate change on U.S. transportation.³

Extreme and Direction of Change	Likelihood of Continued Future Changes in this Century	Key Impacts on Transportation
Warmer and fewer cold days and nights	Very likely ⁴	Positive impact on many forms of transportation by, for example, causing less ice buildup on marine superstructure and easier maintenance of railroad tracks. However, in parts of Alaska where remote mines depend on ice roads, warming will limit the length of time that the ice roads will be open. Also, the thawing of permafrost caused by warming in the Arctic will result in subsidence of roads, rail beds, bridge supports (cave-in), pipelines, and runway foundations.
Hotter and more frequent hot days and nights along with more frequent heat waves and warm spells	Very likely	Increased railroad track buckling and highway rutting, more difficult outdoor maintenance, and decreased lift-off load limits on airplanes.
More frequent and intense heavy downpours and higher proportion of total rainfall in heavy precipitation events	Very likely	Increased flooding of roadways, increases in road wash outs, overloading of drainage systems, increases in soil moisture to the point where they may affect structural integrity of roads, bridges and tunnels.
Increases in area affected by drought	Likely ⁵ in Southwest U.S.	Negative impacts on river transportation routes and increased susceptibility to wildfires causing road closures.
More intense hurricanes	Likely	Greater probability of infrastructure failures, increased damages to road signs, lighting fixtures, and damages to harbor infrastructure from waves and storm surges.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. MARIA CANTWELL TO
THOMAS C. PETERSON

Question 1. Over the past month, we've seen yet another disturbing trend in the Arctic. According to the National Snow and Ice Data Center, the average ice melt rate this May was 3,000 square miles per day faster than last May. As a result, the Arctic ice is now at the low levels seen at this time last year—leading to a likely repeat of last year's unprecedented ice melt.

¹Peterson, Thomas C., Marjorie McGuirk, Tamara G. Houston, Andrew H. Horvitz and Michael F. Wehner, 2008: Climate Variability and Change with Implications for Transportation, *National Research Council*, Washington, D.C., <http://onlinepubs.trb.org/onlinepubs/sr/sr290Many.pdf>, 90 pp.

²CCSP, 2008: Weather and Climate Extremes in a Changing Climate. Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. [Thomas R. Karl, Gerald A. Meehl, Christopher D. Miller, Susan J. Hassol, Anne M. Waple, and William L. Murray (eds.)]. Department of Commerce, NOAA's National Climatic Data Center, Washington, D.C., USA, 164 pp. Available from <http://www.climate-science.gov/Library/sap/sap3-3/finalreport/default.htm>

³Committee on Climate Change and U.S. Transportation, National Research Council, Potential Impacts of Climate Change on U.S. Transportation: Special Report 290, The National Academies Press, Washington, 296 pp.

⁴Very likely means 9 out of 10 times.

⁵Likely means 2 out of 3 times.

Answer. The National Snow and Ice Data Center (NSIDC) is closely monitoring sea ice conditions. While you are correct that melt rates were especially fast in May, the rate of ice loss subsequently slowed. As of early September 2008, the data at NSIDC actually show slightly more Arctic sea ice than at the same time last summer. Data for August indicate the second lowest August sea ice extent.

Question 1a. At what point do we stop saying that each year's record, extreme ice-melt is a fluke and conclude that this is a new state of the Arctic that is here to stay?

Answer. With the current major loss of multi-year ice it would be very difficult for the sea ice to return to conditions of the 1980s.⁶ Sea ice is retreating faster than anticipated by the models run for the Intergovernmental Panel on Climate Change Fourth Assessment Report.⁷ Contributions to this trend include a run of warm years due to natural variability plus an anthropogenic global warming signal produced rapid sea ice loss involving ice/ocean feedbacks (from albedo change) leading to a new state for Arctic sea ice. Models predicted summer sea ice loss after 2050, but because of the combination of these three factors, the Arctic appears now to be on a fast track for summer sea ice loss over the next decades. According to scientists at the NSIDC, the summer Arctic Ocean might be ice-free as early as the year 2030.⁸ An ice-free ocean in summer would be a new state of the Arctic. Due to natural variations in weather patterns, the transition to this new state will not be a smooth process, but will instead be manifested as a jagged series of ups and downs in ice extent from year to year.

Question 1b. Has the decrease in ice thickness affected the melting of sea ice in the Arctic?

Answer. The decrease in ice thickness has impacted the melting of Arctic sea ice as the extent of ice at the end of summer depends strongly on how thick the ice was the previous spring, at the start of the melt season. The thinner the ice in spring, the more easily it is melted out in summer. Thin ice is also more vulnerable to mechanical breakup by storms. As the ice breaks up it becomes easier for the individual chunks (termed floes) to melt. The sea ice cover has thinned substantially over the past few decades, and this has contributed to record low September ice extents that have been observed in recent years, such as in 2007.

Question 1c. Can we expect for ice thickness to continue to decline?

Answer. We expect ice thickness to continue to decline. Already more than half of the older, thicker sea ice in the central Arctic Ocean has been lost. This is part of a feedback cycle. Thinner ice in spring means more open water through summer. Dark open water areas absorb more of the sun's energy than the brighter ice cover. This helps to melt more ice, meaning even more open water. More heat in the ocean also results in slower ice growth in autumn, so that the ice the next spring is even thinner than before.

Question 1d. A scientist at the U.S. National Snow and Ice Data Center has projected that without "an exceptional sequence of cold winters and cold summers" historic levels Arctic sea ice will not rebuild. What is the likelihood of several unusually cold winters and summers occurring given current climate projections?

Answer. The Arctic region always has, and always will, be home to strong natural climate variability. Model results out of the University of Washington⁹ suggest that it could take six cold years to rebuild the thicker sea ice. The likelihood of six cold years in a row is small. A series of cold winters and summers is certainly possible, and the sea ice might recover somewhat in response. However, such recovery would only be temporary, and is expected to become less and less likely as the years pass.

Question 2. Our Nation has billions of dollars invested in transportation infrastructure for the movement of goods and services—infrastructure that will be impacted if transport patterns radically shift due to a warming, ice-free Arctic that opens new shipping routes. When will our ports, rail lines and other transportation

⁶Jinlun Zhang, Research Scientist at the Polar Science Center ran a sea ice model backward to see what it would take to return the ice to conditions before the recent melting. His model results indicated that it would take six to ten cold years, the likelihood of which is small. This work has not yet been published.

⁷Stroeve, J., M. M. Holland, W. Meier, T. Scambos, and M. Serreze (2007), Arctic sea ice decline: Faster than forecast, *Geophys. Res. Lett.*, 34, L09501, doi:10.1029/2007GL029703.

⁸Renfrow, S., 2007: Arctic Sea Ice Shatters All Previous Record Lows, NSIDC Arctic Sea Ice News, 1 October, http://nsidc.org/news/press/2007_seaiceminimum/20071001_press_release.pdf

⁹Jinlun Zhang, Research Scientist at the Polar Science Center ran a sea ice model backward to see what it would take to return the ice to conditions before the recent melting. His model results indicated that it would take six to ten cold years, the likelihood of which is small. This work has not yet been published.

infrastructure start to see the impact of such changing marine transport routes? Will it be sudden and disruptive, or a gradual change that our economy can slowly adapt to?

Answer. At this point, it is difficult to ascertain when we can reasonably expect Arctic shipping to begin, because significant uncertainty exists about further sea ice melting, technology, infrastructure construction, and international treaties. Large scale shipping across a relatively ice free summer Arctic is unlikely to happen in the near future. Nevertheless, the U.S. and other Arctic nations are closely examining potential shipping routes in the Arctic Ocean. The effect of shipping on Arctic sea ice, and the reformation of sea ice each year, should be considered before such shipping begins.

Further, the loss of Arctic sea ice is likely to coincide with other climate change impacts to transportation infrastructure elsewhere, such as compromised rail track due to extreme heat, storm surges and changes in water levels at ports, and extreme weather events, which will impact roads and bridges for trucks. A comprehensive response to climate change is necessary. Any change in international shipping routes can be expected to result in gradual change in freight movements as the transportation sector considers new infrastructure to take advantage of Arctic shipping and begins shifting freight movement patterns.

On June 5, 2008, the Maritime Administration hosted an Arctic Transportation conference. The conference brought together industry, governmental and international transportation officials to focus on the careful and principled development of the immense Arctic Region as an emerging and valuable alternative ocean highway that will provide shorter travel distances for much of the world's international commerce and help relieve existing vessel congestion at the two major inter-ocean canals. Conference members also discussed infrastructure impacts of transport of freight that may result from shifting ice conditions in the Arctic region. Conference members also considered port infrastructure policies and development that will be necessary for safe and environmentally sound transportation of freight in the Arctic region. The Maritime Administration is following up to ensure that potential Arctic transportation programs are established and has created a Marine Excellence Transportation Center for Arctic transportation policies.

Question 3. Given that it can take 10 years to build a polar icebreaker, when should the U.S. Government make the policy commitment to acquiring new icebreakers for the Coast Guard?

Answer. The Administration is currently conducting a policy review and an analysis of mission and infrastructure requirements in the Arctic, so it is premature to speculate on whether or when such a commitment could be made.

Question 3a. The Senate Coast Guard authorization bill currently contains language providing for the construction of new polar icebreakers and the maintenance of the current fleet. Some members of the U.S. Senate, though, are trying to strip that language out of the bill. What would be the implications if our government fails to recapitalize the Coast Guard's fleet of polar icebreakers?

Answer. POLAR STAR was commissioned in 1976 with a designed service life of 30 years. POLAR STAR is currently "in commission, special" caretaker status in Seattle, WA with a support crew of 34. POLAR STAR is not operational. The medium-class HEALY, a very capable science platform, was commissioned in 1999 with a 30 year designed service life, and will be operational for at least another two decades. Under current asset use assumptions, a major overhaul to reactivate and extend the service life of POLAR STAR or to further extend POLAR SEA's service life would be needed to extend the Coast Guard's heavy icebreaking capability past 2014. If the Coast Guard no longer has heavy icebreaking capability, the U.S. could look to assets not owned by the U.S. Government to meet any heavy icebreaking requirements.

Question 3b. What do you believe this would do to U.S. capabilities in the Arctic? Should the government consider this a national security issue?

Answer. Loss of U.S. heavy icebreaking capacity may impact the government's ability to access and exert jurisdiction over some waters in the ice-covered high-latitude Arctic. This could limit our ability to establish maritime domain awareness, assert sovereignty over our waters and Exclusive Economic Zone, and preserve our right to transit international straits. The Administration is currently conducting an Arctic policy process that should address national and homeland security issues.

Question 3c. How would this impact our Nation's research and monitoring capabilities in the Arctic?

Answer. Without heavy icebreaking capabilities, research and monitoring in the high Arctic would be limited to the Arctic summer. Due to its robust science capability, the medium-class icebreaker HEALY is the predominate icebreaker used for

research support in the Arctic, including the mapping of the outer-continental shelf, so there should be minimal impact on the current research program. The HEALY would not be able to support all of the current research programs if the non-science or non-Arctic missions traditionally performed by the heavy icebreakers POLAR SEA and POLAR STAR were transferred to the HEALY. U.S. research in the Arctic is frequently conducted on-board icebreakers operated by other countries, notably Canada, Sweden, and Russia. We will continue to work with our international partners and would need to collaborate more closely with these partners and look at heavy icebreaking vessels not owned by the U.S. Government to continue the research and monitoring capabilities where there are heavy icebreaking requirements.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. DANIEL K. INOUE TO
DR. G. EDWARD DICKEY

Question 1. Which of the recommendations you discussed in your testimony would be performed best by the states and which ones would be suited best for the Federal Government?

Answer. The study committee of which I was a member specifically mentioned a leadership role for the Federal Government in four of the recommendations I discussed in my testimony: Recommendation #4: improving communications among transportation professionals, climate scientists, and other related disciplines, Recommendation #8: reevaluating and developing appropriate new design standards to accommodate climate change, Recommendation #11: new transportation planning regulations requiring inclusion of climate change in transportation and land use plans, and Recommendation #12: reevaluating the National Flood Insurance Program and Flood Insurance Rate Maps. (See response to question #2 for more specifics.) The Federal Government is also mentioned as a partner in research to develop more transportation-relevant decision support tools (Recommendation #5) and to develop and implement sensors and other “smart” technologies for long-term monitoring of climate change effects on transportation infrastructure (Recommendation #7).

No recommendations were targeted solely for state action. Nevertheless, state agencies are mentioned as important partners in several recommendations: Recommendation #1: inventorying critical infrastructure facilities (along with local governments and private infrastructure owners), Recommendation #2: incorporating climate change into investment decisions (along with local governments and private infrastructure owners), Recommendation #3: adopting strategic, risk-based approaches to decisionmaking (all levels of government), Recommendation #5: developing decision-support tools (along with Federal research agencies and universities), Recommendation #9: rebuilding or constructing new infrastructure to higher standards in vulnerable regions (along with Federal funding agencies), and Recommendation #13: providing incentives for regional and multi-state structures to address the regional effects of climate change (along with the Federal Government).

Please note that the recommendations referred to in response to this question and subsequent ones are keyed to my oral testimony. The numbers will sometimes differ from those contained in the Committee report (*Special Report 290: Potential Impacts of Climate Change on U.S. Transportation*, TRB, 2008) because the report recommendations were combined or otherwise reorganized in the testimony in the interest of brevity.

Question 2. How would you suggest Congress or the Federal Government proceed to implement the National Research Council’s recommendations you outline in your testimony?

Answer. The next steps for Congress and Federal agencies to implement the first four recommendations best suited for Federal action listed in the response to question #1 are detailed here:

a. *Recommendation #4:* The National Oceanic and Atmospheric Administration, the U.S. Department of Transportation (US DOT), the U.S. Geological Survey, and other relevant agencies should work together to institute a process for improved communication among transportation professionals, climate scientists, and those in other relevant scientific disciplines, and establish a clearinghouse for transportation-relevant climate change information.

b. *Recommendation #8:* U.S. DOT should take a leadership role along with professional organizations in the forefront of civil engineering practice across all modes to initiate immediately a federally funded, multiagency research program, focused on reevaluation of existing design standards and development of new standards as progress is made in understanding future climate conditions

and the options available for addressing them. A research plan and cost proposal should be developed for submission to Congress for authorization and funding. In addition, it was recommended that U.S. DOT take the lead in developing an interagency working group focused on adaptation. (In the interest of time, this recommendation was not included in the oral testimony.)

c. Recommendation #11: Congress in reauthorizing current surface transportation legislation should modify Federal planning regulations to require that climate change be included as a factor in the development of public-sector, long-range transportation plans; eliminate any perception that such plans be limited to 20 to 30 years; and require collaboration in plan development with agencies responsible for land use, environmental protection, and natural resource management to foster more integrated transportation-land use decisionmaking.

d. Recommendation #12: The Federal Emergency Management Agency, which acts as the insurer of last resort for homeowners in designated flood hazard areas, should reevaluate the risk reduction effectiveness of the National Flood Insurance Program in view of projected increases in intense precipitation and storm activity from climate change. At a minimum, updating flood insurance rate maps to account for sea level rise and incorporate land subsidence should be a priority in coastal areas.

Question 3. Does the Federal Government have the organizational infrastructure in place to be responsive to those recommendations? If so, can you please identify that organization or office?

Answer. I believe the organizational infrastructure is in place to start the implementation process. The study committee tried to be as specific as it could regarding which level of government and which Federal agencies should carry out the recommendations. Each recommendation identifies the organizational element the Committee believes is best suited to lead in implementing the recommendation; these are indicated in my response to question 2.

Question 4. In your opinion, what would be an appropriate timeline to implement the recommendations?

Answer. Implementation of the recommendations can begin almost immediately, without awaiting Federal action. For example, state and local governments and private owners of infrastructure can begin to inventory critical infrastructure (Recommendation #1) and incorporate climate change into investment decisions (Recommendation #2). Recommendations that build on existing experience can also be implemented rapidly. Two examples include making transportation an integral part of local emergency response plans, building on experience of locations where evacuation planning and emergency response are already part of transportation operations (Recommendation #6) and developing a mechanism for sharing best practices regarding responses to climate changes, building on existing technology transfer mechanisms (Recommendation #10). Other recommendations, however, will involve a long-term effort [*e.g.*, reevaluating design standards (Recommendation #8), establishing better communications among transportation professionals, climate scientists, and other relevant scientific disciplines and creating an information clearinghouse (Recommendation #4)] or require new legislation [*e.g.*, transportation planning regulations (Recommendation #11)].

Question 5. As users of climate information and services, what type of data is most important to you and how do you think the Federal Government can improve the climate information and services it provides?

Answer. One of the first tasks of transportation professionals is to identify the types of climate data they need to incorporate climate change into investment and engineering decisions. For example, transportation decisionmakers need to know which climate changes pose the greatest risks for their regions, what the impacts are likely to be at as fine-grained geographic scales possible (*e.g.*, extent of incursion from sea level rise and storm surge combined with land subsidence) along coastal areas, and their likely timing. Information on the changes in the magnitude and frequency of extreme events is often more relevant than changes in the means and medians of distributions of the various measures of climate, such as temperature and precipitation. Many of these data are beyond the current state of the science. Nevertheless, Recommendation #4 suggests a process for relevant Federal agencies to take the lead in furthering information sharing and establishing a clearinghouse for transportation-relevant climate change information as it becomes available.

RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. TED STEVENS TO
DR. G. EDWARD DICKEY

Question. Transportation is the largest industrial contributor of emissions to our atmosphere. Our society cannot function without transportation, however. How can we balance the need for transportation and the need to curb emissions?

Answer. Transportation emissions are a function of the volume of traffic (*i.e.*, ton miles or passenger miles) handled by each of various modes of transportation and the emissions intensity (*e.g.*, emissions per ton mile) for each type of traffic. An increase in total transportation activity can be accompanied by a decrease in total emissions by the transportation sector by adapting technologies that reduce emission intensities (*e.g.*, hybrid automobiles) and by redistributing traffic from a more emission intensive mode to a less emission intensive mode, *e.g.*, by shifting commerce from trucks to railways or waterways. In encouraging modal shifts care must be taken to ensure that public policy does not result in perverse outcomes by causing traffic to shift from a more intensive mode to a less emissions intensive mode with more circuitous routes.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. DANIEL K. INOUE TO
DAVID FRIEDMAN

Question 1. On April 22, 2008, the NHTSA released a notice of proposed rulemaking that would increase fuel economy standards for all cars and light trucks by 4.5 percent per year between 2011 and 2015. Mr. Friedman, do you agree with the assumptions NHTSA relied upon to calculate maximum feasible fuel economy standards?

Answer. To put it simply, NO.

Through the Energy Independence and Security Act (EISA), Congress led the Nation forward on fuel economy for cars and light trucks for the first time in more than three decades. But, instead of setting maximum feasible fuel economy standards as required by law, NHTSA did the bare minimum allowed by Congress due to a variety of faulty assumptions.

Instead of doing the bare minimum to satisfy the law, NHTSA should put cars and trucks on a path to 42 mpg by 2020 and at least 50 mpg by 2030. This would cut global warming pollution from new cars and trucks in half by 2030 and would save about 50 billion barrels of oil through 2050.

A recent UCS report indicates that automakers can cost-effectively boost the fleetwide average fuel economy of cars and trucks to 42 mpg by 2020 and to more than 50 mpg by 2030,¹ with a modest 25 percent penetration of hybrids by 2020.² Yet the recent notice of proposed rulemaking just barely gets cars and trucks on the road to the 35 mpg minimum by 2020, and assumes that hybrids don't enter the market until 2014. Yes, despite the fact that there are more than one million hybrids on the road today, in 2008, and that the Toyota Prius is the 9th best-selling car in America, the analysis NHTSA used assumes hybrids won't reach the market until 2014. People are not sitting around waiting for a hybrid to show up on a dealer's lot in 6 years. They are on 6 month wait lists to buy one because they are already so popular.

There are a number of additional flaws in the base analysis that unnecessarily limit the benefits from the rule by limiting the application of available technology:

- While gasoline prices soared above \$3 per gallon this winter and have hovered around \$4 per gallon this summer, NHTSA relied on projections of \$2.25–\$2.50 per gallon.
- While carbon dioxide futures are currently trading at more than \$40 per metric ton in Europe, NHTSA used a value of \$7 per ton. NHTSA even considered \$0 per ton to be in the range of possible values. In the face of numerous economic analyses which indicate that combating global warming will greatly reduce the cost of adapting to climate change, factoring a \$0 value into the rule is unacceptable.
- NHTSA left out the military and strategic costs of America's oil addiction.
- NHTSA assumed light trucks would grow in market share, but between 2005 and 2008 the market share of light trucks sold from January to May dropped from 54 percent to 48 percent.

¹http://www.ucsusa.org/assets/redesign-documents/clean_vehicles/UCS-Setting-the-Standard.pdf

²http://www.ucsusa.org/news/press_release/new-fuel-economy-proposal-star-0111.html

- NHTSA based its rulemaking on costs and benefits on the margin rather than the total costs and benefits of improved standards.
- For more details on these, and other flaws in the base analysis, please see UCS's formal comments on the NPRM.³

Changes along these lines would redirect NHTSA's rule and EIS to illustrate the full potential of fuel economy standards. *NHTSA's own analysis confirms that simply using more realistic gas prices or switching to an analysis based on total benefits would have led them to propose a fleetwide average of at least 35 mpg by 2015—five years earlier than the required minimum.*⁴ Given the urgency of global warming, and the fact that removing CO₂ early on is essential to reducing the risks of dangerous climate change, NHTSA is significantly underestimating the potential environmental impact of increased fuel economy simply because they are failing to exercise their legal obligation to set standards at maximum feasible levels.

Question 2. When predicting the future costs of greenhouse gas emissions, NHTSA cites a \$7 per ton value on global warming pollution. The Europeans assign a value of \$40 per ton. Which value do you believe best approximates the costs of global warming? Why?

Answer. Both are too low, but at least the value from Europe is a start. The value in Europe is based on "avoidance costs," *i.e.*, what it might cost to avoid the worst impacts of climate change. Given that impacts like the death or displacement of tens of millions in India due to sea level rise, or the cost of increase air pollution in the U.S. from warmer temperatures, devastation of spring and summer water supplies in places like California that rely on snow melt for drinking and irrigation, and many other impacts, the cost of climate change is going to be much higher than the cost of avoiding the worst impacts. Research, such as the Stern report, indicates that costs of ignoring climate change may be as high as 5 percent of GDP while the cost of avoiding climate change may only be 1 percent of GDP.

Further, Europe's current targets are not strong enough to avoid the worst impacts of climate change. Our world needs to dramatically cut global warming pollution if we are to avoid the worst impacts of climate change. For the U.S., that means cutting global warming pollution by 80 percent by 2050, plus significant progress along the way.

Question 3. As users of climate information and services, what type of data is most important to you and how do you think the Federal Government can improve the climate information and services it provides?

Answer. The list of important data is both too long and beyond my expertise to comprehensively discuss here.

When it comes to improving climate information and services, first and foremost, the Federal Government needs to provide adequate funding to NASA, NOAA, EPA and the other important agencies that are part of the front line in developing information on the science, impacts, and solutions to climate change. Climate change represents the single biggest environmental security threat facing the Nation and the world and these agencies should be funded at a level that recognizes this.

Further, the scientists and others working at government agencies should never be allowed to be muzzled and in fact, should be given clear protections in law when they speak out either about the importance of the problem or about the abuse of science within their agencies.

RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. MARIA CANTWELL TO
DAVID FRIEDMAN

Question. There have been several tax incentives targeted toward alternative fuel vehicles, including hydrogen fuel cells, mainly for passenger vehicles. Do you see similar value in adapting those incentives to other modes of transportation, such as rail, or more specifically fuel cell yard locomotives?

Answer. Tax incentives can be very useful tools and should be put to work in ways that provide clear benefit to the Nation in return for the taxpayer dollars that are provided. This means their magnitude should be directly tied to the performance or benefits provided. The greater the benefit, the greater the incentive.

That said, there are clear limits to what tax credits can do and they should not be seen as substitutes for a strong cap and trade system plus specific standards

³http://www.ucsusa.org/assets/documents/clean_vehicles/UCS-2011-2015-CAFE-Comments.pdf.

⁴Pages III-6, IX-12 and IX-13. in NHTSA's Preliminary Regulatory Impact Analysis for their proposed fuel economy standards for Model Year 2011-2015 cars and light trucks.

such as vehicle greenhouse gas standards, low carbon fuel standards, and policies to reduce vehicle miles traveled.

To the specific question of rail yard locomotives, while the greenhouse gas benefits are not very significant, there are substantial local air quality improvements to be made in urban rail yards, ports, airports, and other commerce/shipping hubs that can be provided through electrification (whether through batteries or hydrogen fuel cells).

Well designed tax incentives to encourage electrification of these commerce/shipping hubs could make sense, but the performance metrics associated with those tax credits should be based on both global warming pollution and public health performance. Many sensitive populations have their lives deeply impacted by these facilities and their needs and health should be addressed.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. THOMAS R. CARPER TO
DAVID FRIEDMAN

Question 1. We have had hearings in both this committee and in Environment and Public Works on freight movement. And most witnesses have called for a freight fund and single freight policy. This is because freight is moved by multiple modes of transportation on each trip—truck, train and ship. The system works better when we plan for the movement of the cargo as opposed to the machines moving them. It occurs to me that people are the same way. For example, I drive to the train station, take the train to DC and then walk to the office. What can we do during the transportation reauthorization to shift our policy toward moving people and goods instead of moving cars, trucks, ships, etc.?

Answer. If the goal is to shift moving people and goods in ways that will address global warming, save money, and reduce our oil addiction a top priority in the transportation reauthorization should be to tie Federal funding to the lifetime global warming pollution performance of any project funded. At the end of the day, the Federal Government's strongest transportation infrastructure tool is the power of the purse and tying that purse to performance metrics linked to global warming pollution will help deliver what we need.

Question 2. Transit agencies across the country are struggling to meet increasing demand resulting from high gas prices. At the same time, more people are turning to transit as a clean, affordable way to travel. In fact, the typical public transportation user on average needs to buy half as much gasoline as a person without access to transit. Is the Federal investment in public transportation adequate to serve the public in an era of high gas prices?

Answer. No, the Federal investment in public transportation needs to be stepped up to help make the country more energy independent, to save consumers money and cut global warming pollution. As of 2001, less than one-third of the U.S. population lived within about a block of a bus line, while only about 40 percent lived within a half mile.⁵ The situation is even worse for rail, where only about 10 percent of U.S. population lived within a mile of a rail stop, while only about one quarter lived within five miles.⁶ We need to prioritize greater access to transit for Americans.

The challenge, of course, in today's economy, is where to get the money? And the answer is user fees for highway and other road travel. We need to transition to user fees tied to congestion, pollution, and other important impacts that are not currently included in the daily cost of driving and that are relieved by increased use of public transportation. This is just basic economics, people should pay for the impacts of their road travel and the payments should be given right back to consumers in ways that mitigate the problems.

Question 3. Right now, the Department of Transportation is divided into agencies responsible for a single mode of travel. Further, when I was Governor of Delaware, I found that if we decided to build a road, we could get 80 percent of the funding from the Federal Government. If we chose to invest in transit, we might only receive 50 percent. However, if we decided the best, lowest cost investment was in passenger rail, we got no Federal funds at all. How does this impact the goal of intermodalism? And how might it interfere with the development of an integrated, efficient transportation system?

⁵*Public Transit in America: Analysis of Access Using the 2001 National Household Travel Survey*, Center for Urban Transportation Research, University of South Florida, Tampa, February 2007.

⁶*Ibid.*

Answer. The same fundamental thing missing from America's broader energy and climate policy is also absent when it comes to transportation planning—an actual plan! Instead of looking at individual modes, we need to look at transportation, and all energy use, as a system and we need a comprehensive, long-term plan to move that system in a way that preserves mobility while saving money, cutting oil use and reducing pollution.

There will always be a need for specialized groups within DOT in order for the agency to operate, but there needs to be a systems group that helps bring together each of the pieces to see how they work as a whole. This is similar to some of what has happened in the Energy Efficiency and Renewable Energy group at DOE. EERE has individual projects focusing on many alternative fuels and technologies, whether hybrids or fuel cells or biofuels or conventional vehicles and fuels. But recently, after encouragement from outside studies, they have created a whole group dedicated to looking at all the options at once. This will allow them to compare and contrast the options. Their work is in its early stages and it will not give us black and white answers, but it helps point to the more comprehensive approach that is needed.

All of that said, if such a systems group is to be created, DOT will need more people and resources in areas that have gotten less emphasis, such as public transit and fuel economy.

RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. TED STEVENS TO
DAVID FRIEDMAN

Question. All modes of transportation currently rely on fossil fuels and there are no readily available alternatives. Since demand for oil is steadily increasing, how do we balance the need to increase domestic production of oil with a transition to alternative energy without compromising our transportation needs?

Answer. Thank you for this question.

Honestly, the data does not support the existence of a conflict between domestic production of oil and alternative energy because domestic production potential is too small and too long-term. Current debates around drilling in off-limits areas of the outer continental shelf highlight the issue. According to analysis from the Energy Information Administration, new OCS resources will not deliver in any significant amount until 2020, will have an insignificant impact on oil and gasoline prices even then, and will deliver only about 0.2 million barrels of oil per day, or 3 billion gallons of oil per year, between 2020 and 2030.¹ In comparison, EISA requires the use of at least 20 billion gallons of advanced and cellulosic ethanol by 2022, or the equivalent of 15 billion gallons of oil per year. The potential for low-carbon alternative fuels dwarfs what is available from drilling on off-limits areas of the OCS and drilling.

Even ignoring the significant delays and low volume potential of resources such as off-limits OCS, the U.S. faces a fundamental mismatch between demand and domestic supply of oil. We simply cannot drill our way to improved energy security because our oil resources represent less than 3 percent of the world's supply while use about 25 percent of the world's oil.

This fundamental mismatch points to the need for climate and energy policy that prioritizes reductions in demand while maintaining mobility and shifts to alternatives to oil.

We have ignored rising demand for transportation fuel over the past two decades. Fuel economy was stuck in neutral while driving continued to grow. These are mistakes we cannot afford to repeat.

Last year's energy bill (EISA) represented a good start by requiring the first mandated increase in fuel economy standards since the program first began. The Commerce Committee showed wisdom by including language that ensured that 35 mpg by 2020 was only a minimum, but NHTSA has not followed up on that wisdom and is only just barely on track to meet that minimum despite its own analysis indicating that existing conventional technology can bring cars and trucks to 35 mpg by 2015, 5 years earlier. Analysis by the Union of Concerned Scientists indicates that the combination of existing technology and conventional hybrids would enable cars and trucks to go even farther on a gallon of gasoline to 42 mpg by 2020 and to 55 mpg by 2030.

Taking this path toward improved energy security (42 mpg by 2020, 55 mpg by 2030) would cut consumer costs at the pump by half and would reduce global warm-

¹ EIA, "Impacts of Increased Access to Oil and Natural Gas Resources in the Lower 48 Federal Outer Continental Shelf," 2007, <http://www.eia.doe.gov/oiaf/aeo/otheranalysis/ongr.html>.

ing pollution from new vehicles by the same amount. By 2030 the country would be saving about 4.5 million barrels of oil per day compared to business as usual*2 million barrels per day more than if we just did the minimum required by EISA. At today's oil price of more than \$120 per barrel, that represents a national savings of nearly \$200 billion-a-year. When compared to the potential for 0.2 million barrels per day from off-limits OCS and effectively no consumer savings, it is clear that drilling should not be a priority, while efficiency should receive significant added policy attention.

In addition to increased fuel economy, consumers need alternatives to cars and trucks. This will require increased funding for transit, car-pooling, and telecommuting. In sharp contrast to some recent proposals, highway trust funds should not be diverted away from these alternatives. In fact these alternatives need significantly more funding, which could be raised from per-mile fees that would cover wear-and-tear, the costs of congestion, and the environmental and energy security costs of oil use.

Finally, since cars and trucks will remain an important part of personal mobility, additional renewable energy resources must be developed. This means increased reliance on low-carbon biofuels made from waste or other biomass resources that do not put pressure on the agricultural system. In the longer run it means a transition to cars and trucks that rely on electricity and hydrogen instead of liquid fuels. Significant amounts of electricity and hydrogen can be produced from renewable, domestic resources and will ultimately allow us to end our reliance on oil.

Thank you.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. DANIEL K. INOUE TO
ED HAMBERGER

Question 1. One method of regulating greenhouse gas emissions is a cap and trade system. How do you see an overall cap and trade system influencing the transportation marketplace?

Answer. It would depend on the scope of the cap and trade system. For example, a cap and trade system that covered only the power generation sector would affect the mix of commodities carried by freight transporters as (1) the power sector moved away from carbon-intensive fuels such as coal; and (2) the sector passed the subsequent higher costs of electricity production on to manufacturers, farmers, retailers and other commercial enterprises.

A broader, economy-wide cap and trade system covering all sectors, including transportation, would likely lead to higher fuel prices and higher transportation rates. How these higher costs would ultimately play themselves out among all economic sectors is difficult to ascertain beforehand. Depending upon the stringency of the cap and the costs of compliance, one potential outcome is that the relative fuel efficiency of rail over truck transport would lead to a relative shift in freight traffic from truck to rail.

Question 2. What impact do you think such a cap and trade system would have on overall coal loadings in the railroad industry?

Answer. It would depend upon the nature of the cap and trade system that was enacted. A cap and trade system incorporating a "safety valve," such as that found in S. 1766, would have a less significant impact on coal loadings than the system in S. 2191, which does not contain a safety valve. A second consideration would be the extent to which the emissions reduction timetable in a particular cap and trade system is in alignment with the expected commercial availability of carbon capture and storage (CCS) technology. Phasing in carbon reduction limits over a time period sufficient to allow CCS to mature would ensure that utilities are not forced to abandon coal generation as an option.

Question 3. As users of climate information and services, what type of data is most important to you and how do you think the Federal Government can improve the climate information and services it provides?

Answer. The rail industry depends more heavily on Federal weather data than it does on Federal climate data. Weather data is critical to day-to-day rail operations. Climate data is only relevant in terms of very long-term trends.

RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. MARIA CANTWELL TO
ED HAMBERGER

Question. As efforts are made to reduce the carbon footprint of individual modes, such as the experimental fuel cell locomotive under development—is there anything

the Federal Government can or should do to promote or accelerate research and development of new technologies?

Answer. We regret that the House is presently considering legislation to promote technologies to increase the fuel efficiency of medium-to-heavy duty commercial trucks—but not similar legislation to promote locomotive technologies. We find it similarly unfortunate that the Department of Energy for many years has funded heavy-duty truck fuel efficiency research, but not rail fuel efficiency research. We believe that public policymakers should treat both modes similarly.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. THOMAS CARPER TO
ED HAMBERGER

Question 1. We have had hearings in both this committee and in Environment and Public Works on freight movement. And most witnesses have called for a freight fund and single freight policy. This is because freight is moved by multiple modes of transportation on each trip—truck, train and ship. The system works better when we plan for the movement of the cargo as opposed to the machines moving them. It occurs to me that people are the same way. For example, I drive to the train station, take the train to DC and then walk to the office.

Answer. The industry has recently adopted a series of 11 principles that it plans to use to evaluate proposals to establish a Federal freight fund. These principles are attached.

Question 2. Right now, the Department of Transportation is divided into agencies responsible for a single mode of travel. Further, when I was Governor of Delaware, I found that if we decided to build a road, we could get 80 percent of the funding from the Federal Government. If we chose to invest in transit, we might only receive 50 percent. However, if we decided the best, lowest cost investment was in passenger rail, we got no Federal funds at all. How does this impact the goal of intermodalism? And how might it interfere with the development of an integrated, efficient transportation system?

Answer. Freight railroads are the backbone of North America's freight transportation network, accounting for more than 40 percent of all freight transportation. Yet capacity limits threaten to reduce the freight rail market share as well as encumber any expansion of passenger rail in coming decades. To address this economic and environmental challenge, the rail sector supports enactment of S. 1125, the "Freight Rail Infrastructure Capacity Expansion Act." In terms of funding from the Federal Government, see answer to #1 (above).

ASSOCIATION OF AMERICAN RAILROADS

Final AAR Principles on Federal Funding of Freight Rail

There is a growing consensus that the Nation faces transportation challenges that could threaten the competitiveness of U.S. producers and products and the mobility of our citizens. The opportunity exists for railroads to play a significantly-expanded role in addressing growing transportation congestion and related societal problems such as pollution, safety, and energy independence.

Railroads are private companies that invest 17 percent of their revenue on capital spending for plant and equipment, a figure higher than virtually any other industry and five times the average for all manufacturing. Despite this record level of investment, future expenditures necessary to expand capacity to fully meet projected demand for railroad services and to meet other national objectives will be considerable.

The rail freight community is prepared to contribute private capital to fund its share of proposed partnerships with the public sector. Public benefits—such as congestion mitigation and pollution reduction—which can result from projects associated with expanded freight utilization—are valid policy objectives for which public funding is appropriate. Public-private partnerships do not represent a subsidy of private beneficiaries, since a rail carrier will contribute commensurate with any benefits it may realize when it chooses to participate.

If government policymakers determine that projects provide public benefits worthy of support, then policymakers must be willing to commit public funds commensurate with that determination, rather than relying on freight railroads to cross-subsidize the projects to the detriment of their own investment needs. Private freight railroads should be expected to participate financially in individual projects, but only based on the direct benefits they will receive.

It is essential that private railroad investment continue to focus on network expansion and renewing and refreshing existing infrastructure. Railroads cannot also

support the public's participation in and benefits derived from infrastructure projects.

Accordingly, AAR subscribes to the following eleven Federal funding principles, which fall into three categories. The first nine principles assure that Federal funding will create sustainable partnerships with public entities while maximizing the public benefits found in rail projects. The tenth promotes freight rail as a solution to looming transportation challenges. The eleventh clarifies that grade separations do little to benefit rail capacity or rail productivity.

1. Federal funding and policies must not reduce and should encourage private investment in the Nation's rail system.
2. In all public-private partnerships, public benefits should be funded by public funds, and railroad benefits should be funded by railroad funds.
3. The same funding principles should apply to projects involving other modes of freight transportation.
4. If the Federal Government establishes a freight fund to fund public benefits of freight rail projects, funding should not be extracted from freight transportation providers or their customers or disadvantage the economics of rail transportation. Further, freight railroads should not be required to assess or collect any fees. The rail logistics system should not be saddled with increased costs to fund public benefits, either directly or through a freight fund.
5. Federal fees associated with a freight fund should preempt state and local fees, unless there is mutual agreement among the parties.
6. Any involvement by a rail carrier in public-private projects must be strictly voluntary.
7. Federal funding of public benefits must not be in lieu of the enactment of Federal investment tax incentives for increased private investment.
8. Federal funding must not be conditioned upon a change in the present economic regulation of the rail industry or other industry concessions.
9. Federal funding must be executed in a manner that preserves the rail industry's current ownership rights.
10. Federal freight investment should focus on key transportation projects with significant public benefits, such as eliminating rail chokepoints, improving service to shippers, facilitating international trade, reducing greenhouse gas emissions, cutting vehicle miles traveled, and improving safety. Such projects should be selected based upon standardized, agreed-upon methodology.
11. Grade separations must continue to be regarded as primarily beneficial to the highway/road user. They do little to increase freight rail capacity or improve rail productivity.

Additional AAR Principles on the Reauthorization of SAFETEA-LU

In addition to its principles on Federal funding of freight rail, AAR's principles for the reauthorization of SAFETEA-LU include:

- Support for separate funding for the Section 130 program;
- Support for separate funding for intermodal connectors;
- Support for funding for Operation Lifesaver;
- Opposition (on economic grounds) to a thaw of the freeze on longer and heavier trucks operating on the interstate highway system; and
- Support for public private partnerships such as CREATE and the New Orleans gateway project.

RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. TED STEVENS TO
ED HAMBERGER

Question. Rail transportation is the most efficient in terms of miles per gallon of diesel (over 400 mpg). What can be done to get more passengers and freight on railroads while keeping in mind both still require other modes of transportation?

Answer. Comprehensive, reliable, and cost-effective rail service is critical to our nation, and that, in turn, requires having adequate rail capacity. Railroads must be able to both maintain their extensive *existing* infrastructure and equipment and build the substantial *new* capacity that will be needed to meet much higher future freight and passenger transport demand.

Our privately-owned freight railroads are working hard every day to help make sure America has the rail capacity it needs. They're re-investing record amounts in

their systems (\$420 billion from 1980 to 2007, or more than 40 cents out of every revenue dollar), adopting innovative new technologies and operating plans, and forging partnerships with each other, other transportation providers, and customers.

Policymakers can help ensure that more freight and passengers move by rail by addressing a number of serious impediments to meeting the rail capacity challenge. A few of these impediments are discussed briefly below.

Local Opposition to Rail Projects

Under existing law, state and local regulations (other than local health and safety regulations) that unreasonably interfere with rail operations are preempted by Federal regulations. These Federal regulations protect the public interest while recognizing that our railroads form an integrated, national network that requires a uniform basic set of rules to operate effectively.

Nevertheless, rail expansion projects often face vocal, sophisticated opposition by members of affected local communities. In many cases, railroads thus face a classic “not-in-my-backyard” problem—even for projects for which the benefits to a locality or region far outweigh the drawbacks.

In the face of local opposition, railroads try to work with the local community to find a mutually-satisfactory arrangement, and these efforts are usually successful. When agreement is not reached, however, projects can face seemingly interminable delays and sharply higher costs.

Often, local communities allege violations of environmental requirements to challenge a proposed project, even though detailed environmental reviews, when required, already identify the impacts of rail projects and determine necessary mitigation measures. Railroads understand the goals of environmental laws and appreciate the need to be responsive to community concerns, but community opposition to rail operations can be a significant obstacle to railroad infrastructure investments, even when the opposition has no legal basis.

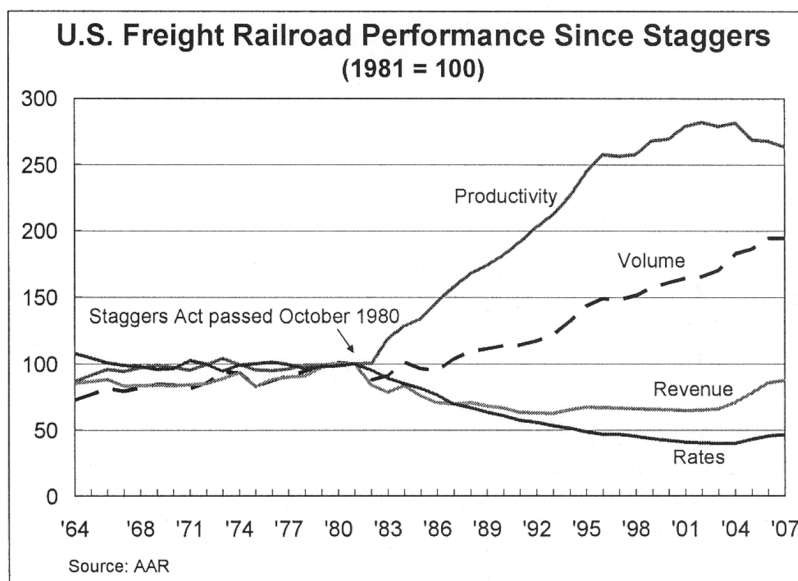
Policymakers can help by taking steps to shorten the time it takes for reviews of rail expansion projects in ways that do not adversely affect the quality of those reviews.

Financial Sustainability

Because U.S. freight railroads are overwhelmingly privately owned and must finance the vast majority of their infrastructure spending themselves, capacity investments carry substantial financial risk. Accordingly, these projects must pass appropriate internal investment hurdles—*i.e.*, the investments will be made only if they are expected to generate an adequate return. That’s why policymakers should say no to the re-regulation of railroads.

Prior to 1980, decades of government over-regulation had brought U.S. freight railroads to their knees. Bankruptcies were common, rates were rising, safety was deteriorating, and rail infrastructure and equipment were in increasingly poor condition because meager rail profits were too low to pay for needed upkeep and replacement. Recognizing the need for change, Congress passed the Staggers Rail Act of 1980, which partially deregulated the rail industry.

The record since Staggers shows that deregulation works. Since 1981, rail traffic is up 95 percent, rail productivity is up 163 percent, and average inflation-adjusted rail rates are down 54 percent. And rail safety is vastly improved—the train accident and employee injury rates have plunged since Staggers. Our privately-owned, largely deregulated freight railroads competing fairly in the transportation marketplace have produced the best freight rail system in the world.



Despite the severe harm excessive rail regulation caused prior to Staggers and the enormous benefits that have accrued since then, legislation has been proposed—most recently, S. 953/H.R. 2125 (the so-called “Railroad Competition and Service Improvement Act of 2007”) in the 110th Congress—that would re-regulate freight railroads.

Re-regulation is bad public policy and should be rejected. It would prevent railroads from earning enough to make the massive investments a first-class rail system requires. As the Congressional Budget Office has noted, “As demand increases, the railroads’ ability to generate profits from which to finance new investments will be critical. Profits are key to increasing capacity because they provide both the incentives and the means to make new investments.”

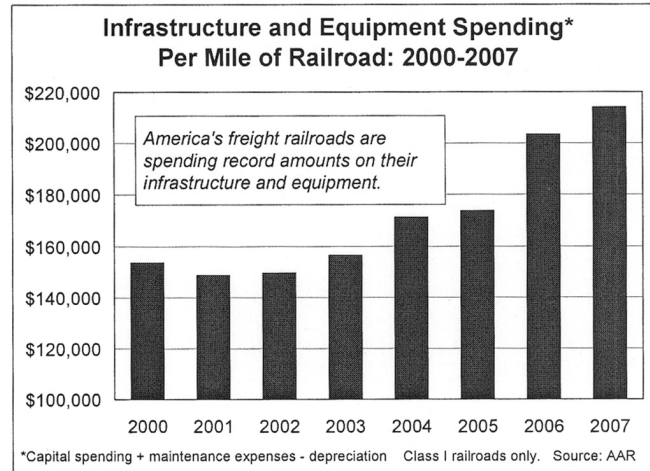
Under re-regulation, rail earnings, and therefore rail spending on infrastructure and equipment, would plummet; the industry’s existing physical plant would deteriorate; needed new capacity would not be added; and rail service would become slower, less responsive, and less reliable. It would mean less freight moving by rail when we should have more.

As the Government Accountability Office (GAO) recently noted, “Without a doubt, rates have decreased for most shippers, and most shippers are better off in the post-Staggers environment than they were previously. This outcome suggests that widespread and fundamental changes to the relationship between the railroads and their customers are not needed.”

Public Involvement in Freight Rail Infrastructure Investment

Rail transportation demand is projected to rise sharply in the years ahead as our population and economy grow. The U.S. Department of Transportation (DOT) recently forecast, for example, that U.S. freight railroad demand will rise 88 percent by 2035.

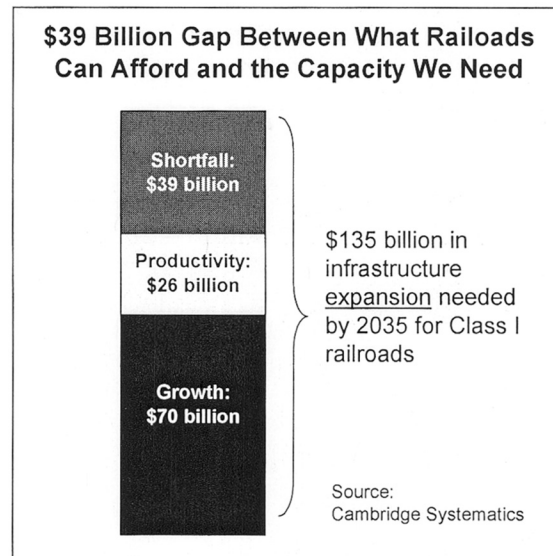
Railroads will continue to spend massive amounts of their own funds to address their capacity challenges. However, they are, and will continue to be, unable to pay for the socially-optimal amount of rail capacity.



The magnitude of the looming freight rail capacity issue was borne out by a recent study by Cambridge Systematics, a prominent economic and transportation consulting firm. The purpose of the study, which focused on 52,000 miles of primary freight rail corridors, was to estimate the cost of the expansion in rail capacity necessary for America's freight railroads to handle the 88 percent increase in rail traffic forecast by the DOT for 2035.

The study found that if rail capacity needs are not properly addressed, by 2035 some 16,000 miles of primary rail mileage—nearly one-third of the 52,000 miles covered in the study—will be so congested that a widespread service breakdown environment would exist. (Today, less than 1 percent of rail miles are that congested.) Because our rail system is interconnected, this outcome would mean that America's entire rail system would, in effect, be disabled.

Class I railroads are anticipated to be able to generate (through earnings growth from the additional traffic and productivity gains) only \$96 billion of the \$135 billion needed for new capacity identified by the Cambridge Systematics study. Addressing this shortfall is critical if railroads are to fulfill their potential in meeting America's freight transportation challenges.



One way to help bridge the funding gap is through *tax incentives for rail infrastructure investments*. S. 1125/H.R. 2116 (the “Freight Rail Infrastructure Capacity Expansion Act of 2007”) calls for a 25 percent tax credit for investments in new track, intermodal facilities, yards, and other freight rail infrastructure projects that expand rail capacity. All businesses that make capacity-enhancing rail investments, not just railroads, would be eligible for the credit.

A rail ITC would address the central challenge of how to move more freight without causing more highway gridlock or environmental degradation. For a railroad considering whether to fund an expansion project, an ITC would reduce the cost of the project, raising the likelihood that the project will be economically viable. It would help worthwhile projects get built sooner, but would not be enough to cause economically-unjustified projects to go forward.

An ITC would also stimulate the economy. U.S. Department of Commerce data indicate that every dollar of freight rail infrastructure investment that would be stimulated by a rail infrastructure ITC would generate more than three dollars in total economic output. Each \$1 billion of new rail investment induced by the ITC would create an estimated 20,000 jobs nationwide. The benefits to our economy would be broad and long lasting.

Policymakers should also support a *short line tax credit*. Since 1980, more than 380 new short lines have been created, preserving thousands of miles of track (much of it in rural areas) that may otherwise have been abandoned. In 2004, Congress enacted a 50 percent tax credit (“Section 45G”) for investments in short line track rehabilitation. The focus was on assisting short lines in handling the larger and heavier freight cars that are needed to provide their customers with the best possible rates and service.

Since Section 45G was enacted, hundreds of short lines have rapidly increased the volume and rate of their track rehabilitation and improvement programs. Unfortunately, Section 45G expired in 2007. Pending legislation in Congress (S. 881/H.R. 1584, the “Short Line Railroad Investment Act of 2007”) would extend this tax credit and thus preserve the huge benefits it delivers.

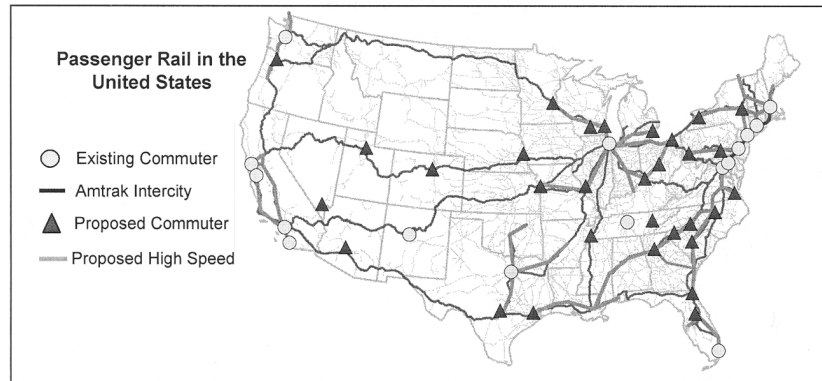
Finally, a more pronounced use of *public-private partnerships* would help get more freight on our rails. Public-private partnerships reflect the fact that cooperation is more likely to result in timely, meaningful solutions to transportation problems than a go-it-alone approach. Without a partnership, projects that promise substantial public benefits (including reduced highway gridlock and highway construction and maintenance costs, reduced pollution and greenhouse gas emissions, and enhanced mobility) in addition to private benefits are likely to be delayed or never started at all because it would be too difficult for either side to justify the full investment needed to complete them. In contrast, if a public entity shows it is willing to devote public dollars to a project based upon the public benefits that will accrue, the private entity is much more likely to provide the private dollars (commensurate with private gains) necessary for the project to proceed.

Partnerships are not “subsidies” to railroads. Rather, they acknowledge that private entities should pay for private benefits and public entities should pay for public benefits. In many cases, these partnerships only involve the public contributing a portion of the initial investment required to make an expansion project feasible, with the railroad responsible for keeping the infrastructure productive and in good repair.

Promoting Passenger Rail

Freight railroads are successful partners with passenger railroads all over the country. Around 97 percent of the 22,000 miles over which Amtrak operates are owned by freight railroads, and hundreds of millions of commuter trips each year occur on commuter rail systems that operate at least partially over tracks or right-of-way owned by freight railroads.

The potential national benefits of a strong national passenger rail system are significant. The key question is: under what circumstances can freight and passenger interests advance this worthy goal?



U.S. freight railroads are moving more freight than ever before, and demand for freight rail service is projected to grow sharply in the years ahead. Passenger rail growth would come on top of growth in freight traffic. That's why, going forward, capacity will likely be the single most important factor determining our ability to provide the high quality rail service that will be essential for both freight and passengers.

While recognizing existing Amtrak statutory authority regarding use of freight railroad- owned facilities, the AAR has developed principles which we believe should govern new passenger rail use of freight-owned facilities:

- Freight railroads should not be forced to give passenger railroads access to their property; rather, access should be voluntarily negotiated.
- Freight railroads should be fully compensated for the use of their assets by passenger trains.
- Freight railroads should be adequately protected from liability.
- Freight railroads should not be asked to pay for capacity increases needed to accommodate passenger service.

These principles are grounded in the tremendous importance of freight railroads to America. Freight railroads lower shipping costs by billions of dollars each year and produce an immense competitive advantage for our farmers, manufacturers, and miners in the global marketplace. If passenger railroads impair freight railroads and force freight that otherwise would move by rail onto the highway, those advantages would be squandered. Moreover, highway gridlock would worsen; fuel consumption, pollution, and greenhouse gas emissions would rise; and our mobility would deteriorate—outcomes that are contrary to the goals of expanding passenger rail in the first place.

For these reasons, passenger rail progress must be complementary to—not in conflict with—freight rail development.

That said, there clearly are substantial public benefits from expanded passenger rail. Indeed, as the cost of auto and air travel continues to increase and the prospect of a carbon-constrained future increases, we have an opportunity—and the need—to make far more concerted efforts than we have in the past to more fully capture the economic, environmental, and social benefits of reliable, convenient, and comprehensive passenger rail service.

But in order to be a true transportation alternative for Americans, passenger rail, like freight rail, cannot be achieved on the cheap. Without significant additional investment in infrastructure and equipment, Amtrak will not be able to handle all the people that want to use it and we will fail to capture all of those benefits.

We believe that future passenger rail initiatives, especially regional or national high-speed initiatives, will require separate assets dedicated to passenger operation. This more visionary approach would enable faster and more reliable passenger service and minimize the substantial operational, engineering, legal, and other impediments that often hinder the ability of freight railroads to accommodate passenger trains.

This approach will be costly, but so will any approach to meaningfully enhance passenger rail. Freight railroads believe that the public benefits of a truly attractive and competitive national passenger rail capability will exceed public costs, and look

forward to continue to work with all appropriate parties to make those benefits a reality.

One way railroads are doing this is by working closely with Amtrak to alleviate problems that are hindering Amtrak's performance and reliability. Individual freight railroads are currently working directly with Amtrak to identify areas where targeted infrastructure improvements that eliminate chokepoints can be made, and where dispatching and maintenance practices can be improved. Joint, cooperative efforts like these are far more likely to result in meaningful improvements than a punitive approach. Imposing monetary penalties on freight railroads based on Amtrak on-time performance, for example, would be neither constructive nor appropriate.

Other Transportation Modes

Obviously, neither freight or passenger railroads operate in a vacuum. Trucks, for example, are and will continue to be absolutely critical to freight transportation and to our economy. That's why significant attention must be paid, and appropriate resources devoted to, other transportation infrastructure. Working as a whole, our various transportation networks will help ensure that freight and people can get to where they need and want to be efficiently and cost effectively.

